Workshop Manual

Audi A6 2011 ➤
Audi A6 Avant 2011 ➤
Audi A6 China 2012 ➤
Audi A7 Sportback 2011 ➤

Direct petrol injection and ignition system (4-cyl. 2.0 ltr. 4-valve turbo with timing chain)									
Engine ID	CAE B	CDN B	CHJA	CDZ A	CPE A				

Edition 06.2012

List of Workshop Manual Repair Groups

Repair Group

24 - Mixture preparation - injection

28 - Ignition system

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents

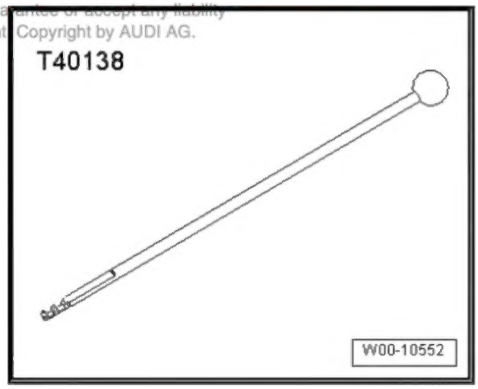
24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

Overview

1.1 General notes on self-diagnosis

- The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.
- The vehicles are fitted with a crash/fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the fuel pump relay.
- If the battery is not disconnected, the fuse for the fuel pump control unit -J538- (located in the fuse carrier in the driver's side of the dash panel) must be removed as a precaution before opening the fuel system, because the fuel pump will otherwise be activated by the contact switch on the driver's door.
- Use release tool -T40138- to unplug connectors that cannot be accessed easily.



1.2 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:

WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

1.3 Safety precautions for vehicles with start/stop system

WARNING

Risk of injury due to automatic engine start on vehicles with start/stop system.

- *On vehicles with activated start/stop system (this is indicated by a message in the instrument cluster display), the engine may start automatically on demand.*
- *Therefore it is important to ensure that the start/stop system is deactivated when performing repairs (switch off ignition, if required switch on ignition again).*

1.4 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

WARNING

- *If the battery is not disconnected, the fuse for the fuel pump control unit -J538- must be removed as a precautionary measure before opening the fuel system because the fuel pump will otherwise be activated by the contact switch on the driver's door.*
- *The fuel system is pressurised. The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ page 8 .*
- *The connection must be opened immediately after reducing the pressure; wrap a cloth around the connection and allow the residual pressure (approx. 7 bar) to dissipate.*

Note

Removing the fuse (located in fuse carrier in dash panel on driver's side) will interrupt the power supply from »terminal 30« for the fuel pump control unit -J538- . ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system and injection system:

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Plug open lines and connections with suitable protective caps immediately.
- Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

1.5 Safety precautions when working on the ignition system

To prevent injuries to persons and/or irreparable damage to the fuel injection and ignition system, the following must be noted:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and gas-discharge headlights.
- Do not open any fuel line connections while the engine is running.
- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from ignition coils and remove fuse for electric fuel pump.
- Certain tests may lead to a fault being detected by the control unit and stored. The event memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- If the event memory has been erased, you must generate the readiness code again.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- If the engine has to be operated at starting speed without actually starting (e.g. to test compression pressure), detach the four connectors from the ignition coils using puller -T40039- . Also remove fuse for fuel pump control unit -J538- .

1.6 Warning instructions when working on vehicles with high-voltage system

Vehicles with hybrid drive

- ⇒ „1.6.1 Safety precautions for de-energising high-voltage system“, page 4
- ⇒ „1.6.2 Safety precautions for re-energising high-voltage system“, page 5
- ⇒ „1.6.3 General safety precautions and repair instructions“, page 6

1.6.1 Safety precautions for de-energising high-voltage system

- The high-voltage system may only be de-energised by a suitably qualified person (Audi high-voltage technician). Please refer to ⇒ Electrical system; Rep. gr. 93 for a definition and explanation of the relevant qualifications.
- The system must first be de-energised before any work is done on the high-voltage system ⇒ Electrical system; Rep. gr. 93 .
- The types of work for which the high-voltage system has to be de-energised are indicated in the instructions for the procedure. For further information on the procedure for de-energising the high-voltage system please refer to ⇒ Electrical system; Rep. gr. 93 .
- Read and observe all additional warnings and descriptions for work on the high-voltage system ⇒ Electrical system; Rep. gr. 93 .

Note

In the event of queries or uncertainty regarding the terms „electrically instructed person“, „Audi high-voltage technician“, „Audi specialist for work on high-voltage systems“ or the high-voltage system itself, the relevant importer must be contacted prior to the start of all work.

For work that requires de-energising of the high-voltage system, please note:

The high-voltage system must be de-energised according to the `Guided Fault Finding` routine in the ⇒ vehicle diagnostic tester , and ONLY by this method.

DANGER!

High voltage can cause fatal injury.

Danger of severe or fatal injuries from electric shock.

- *For reasons of safety, persons with life-preserving or other electronic medical devices in or on their body must not perform any work on the high-voltage system. Such medical devices include internal analgesic pumps, implanted defibrillators, pacemakers, insulin pumps and hearing aids.*
- *The high-voltage system may only be de-energised by a suitably qualified person (Audi high-voltage technician).*
- *It must be definitely confirmed that the high-voltage system is de-energised. The system may only be de-energised using the vehicle diagnostic tester via „Guided Fault Finding".*
- *The qualified person (Audi high-voltage technician) confirms that the system is de-energised and uses the locking cap -T40262- to ensure that the system cannot be re-energised. The ignition key and the maintenance connector for high-voltage system - TW - are then stored in a safe place by the qualified person.*
- *The qualified person (Audi high-voltage technician) marks the vehicle by attaching the appropriate warning signs.*

1.6.2 Safety precautions for re-energising high-voltage system

- The high-voltage system may only be re-energised by a suitably qualified person (Audi high-voltage technician). Please refer to ⇒ Electrical system; Rep. gr. 93 for a definition and explanation of the relevant qualifications.
- Re-energising the high-voltage system ⇒ Electrical system; Rep. gr. 93 .
- Read and observe all additional warnings and descriptions for work on the high-voltage system ⇒ Electrical system; Rep. gr. 93 .

Note

In the event of queries or uncertainty regarding the terms „electrically instructed person", „Audi high-voltage technician", „Audi specialist for work on high-voltage systems" or the high-voltage system itself, the relevant importer must be contacted prior to the start of all work.

The high-voltage system must be re-energised according to the `Guided Fault Finding` routine in the ⇒ vehicle diagnostic tester , and ONLY by this method.

DANGER!

High voltage can cause fatal injury.

Danger of severe or fatal injuries from electric shock.

- *For reasons of safety, persons with life-preserving or other electronic medical devices in or on their body must not perform any work on the high-voltage system. Such medical devices include internal analgesic pumps, implanted defibrillators, pacemakers, insulin pumps and hearing aids.*
- *The high-voltage system may only be re-energised by a suitably qualified person (Audi high-voltage technician).*
- *The system may only be re-energised using the vehicle diagnostic tester via „Guided Fault Finding".*
- *The vehicle is then made ready for operation again by the qualified person (Audi high-voltage technician).*
- *The qualified person (Audi high-voltage technician) marks the vehicle by attaching the appropriate warning signs.*

1.6.3 General safety precautions and repair instructions

- Read and observe all additional warnings and descriptions for work on the high-voltage system ⇒ Electrical system; Rep. gr. 93 .

Note

In the event of queries or uncertainty regarding the terms „electrically instructed person", „Audi high-voltage technician", „Audi specialist for work on high-voltage systems" or the high-voltage system itself, the relevant importer must be contacted prior to the start of all work.

For work in the vicinity of high-voltage components and visual inspection of high-voltage components:

DANGER!

Risk of fatal injury if high-voltage components are damaged.

Observe the following when working in the vicinity of high-voltage components or wiring:

- *It is not permitted to use cutting or forming tools, other sharp-edged tools or heat sources such as welding, brazing, soldering, hot air or thermal bonding equipment.*
- *Before starting work, visually inspect the high-voltage components in the areas involved.*
- *Before working in the engine compartment, visually inspect the power and control electronics for electric drive -JX1- , electric drive motor -V141- , air conditioner compressor -V470- and high-voltage wiring.*
- *Before working on the vehicle underbody, visually inspect the high-voltage wiring and covers.*
- *Before working on the rear section of the vehicle, visually inspect the high-voltage wiring and the electro-box with the maintenance connector for high-voltage system - TW - .*
- *Visually inspect all potential equalisation lines.*

Check the following when making the visual inspection:

- *There must be no external damage on any component.*
- *The insulation of the high-voltage wiring and potential equalisation lines must not be damaged.*
- *There must be no unusual deformation of the high-voltage wiring.*
- *All high-voltage components must be identified by a red warning sticker.*

For work that requires the ignition to be switched on:

DANGER!

When working on a vehicle with the ignition switched on or while the drive system is active, the engine can start unexpectedly and exhaust fumes can cause a health hazard in closed rooms. Moving parts can trap or draw in parts of the body and/or clothing (safety hazard).

Before switching on the ignition, perform the following steps:

- *Move selector lever to position P*
- *Activate parking brake*
- *Switch off ignition.*
- *Open bonnet*
- *Connect battery charger (e.g. -VAS 5095A-) to jump-start connections of 12 V electrical system.*
- *Switch on ignition*

General safety precautions and safety precautions for work that requires the ignition to be switched off:

WARNING

Safety hazard: the engine can start unexpectedly.

Before carrying out general work on a vehicle with high-voltage electrical system, switch off the ignition and remove the ignition key from the vehicle.

WARNING

Working on vehicles with high-voltage wiring:

- *Do not support yourself or tools on high-voltage wiring or associated components --> this can damage the insulation.*
- *High-voltage wiring must not be excessively bent or kinked --> this can damage the insulation.*
- *The round high-voltage connectors are colour-coded with an external coloured ring and are provided with mechanical coding or guide lugs. It is important to observe this coding when joining up the round high-voltage connectors, otherwise the connectors can be damaged.*

1.7 Reducing pressure in high-pressure section of injection system

Overview

- ⇒ „1.7.1 Reducing pressure - vehicles with engine codes CAEB, CDNB and CDZA“, page 8
- ⇒ „1.7.2 Reducing pressure - vehicles with engine code CHJA“, page 10

1.7.1 Reducing pressure - vehicles with engine codes CAEB, CDNB and CDZA

Special tools and workshop equipment required

- ⇒ Vehicle diagnostic tester

WARNING

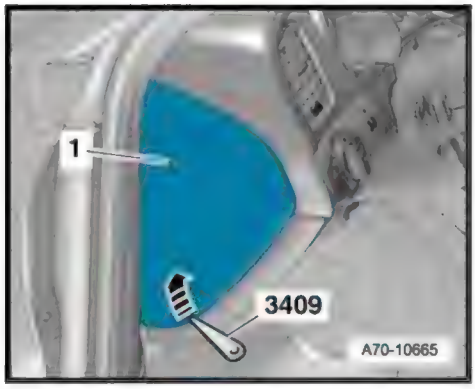
The fuel system operates at extremely high pressure. This can cause injury.

- *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).*
- *Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender -G247-), the fuel pressure in the high-pressure section must be reduced to a specified level. The procedure is described below.*

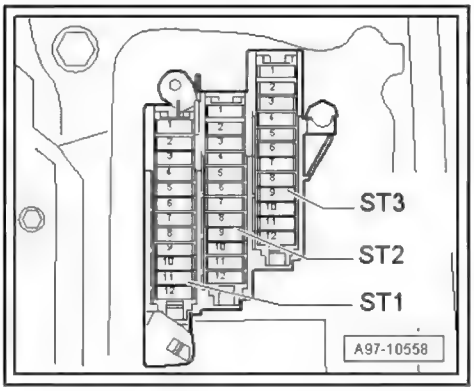
Reducing fuel pressure in high-pressure section:

– Connect a ⇒ Vehicle diagnostic tester.

- Start engine and run at idling speed.
- Select „Engine electronics“ in vehicle self-diagnosis.
- Then select „Measured values“.
- Select „Fuel pressure“ from the list.
- With the engine idling, the fuel pressure displayed will be between 30 and 40 bar.
- Pry off cover -1- on left side/right side of dash panel using removal wedge -3409- -arrow- or similar.



– With engine idling, pull out fuse for fuel pump control unit - J538- in fuse carrier in dash panel (driver's side) ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



Note

Removing the fuse will interrupt the voltage supply »terminal 30« for the fuel pump control unit -J538- .

– Observe fuel pressure in display zone.

• The fuel pressure will decrease very quickly because the mechanical high-pressure pump is no longer being supplied with fuel from the fuel tank by the fuel pump -G23- .

– Switch off ignition as soon as fuel pressure has dropped to approx. 8 bar.

Note

Fuel pressure must not fall below 6 bar, otherwise the engine will stall (this could damage the catalytic converter).

WARNING

There is a risk of injury: avoid skin contact with fuel.

- *The fuel lines are still filled with fuel, however the fuel is no longer under high pressure. Wear safety goggles and protective clothing when opening the fuel system.*
- *Before opening the high-pressure section, wrap a cloth around the connection.*

– The high-pressure system must be opened »immediately« after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

Note

- *The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.*
- *The ignition must not be switched on again from this point on as this would increase the pressure again.*

1.7.2 Reducing pressure - vehicles with engine code CHJA

Special tools and workshop equipment required

- ⇒ Vehicle diagnostic tester

WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).*
- *Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender -G247-), the fuel pressure in the high-pressure section must be reduced to a specified level. The procedure is described below.*

Reducing fuel pressure in high-pressure section:

– Connect ⇒ Vehicle diagnostic tester, select function „Reducing fuel pressure“ in „Guided Functions“ and follow on-screen instructions.

• Fuel pressure will drop to a specified value.

– Switch off ignition.

The fuel rail is still filled with fuel, however it is no longer under high pressure.

WARNING

There is a risk of injury: avoid skin contact with fuel.

- *Wear safety goggles and protective clothing when opening the fuel system.*
- *Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.*

– The high-pressure system must be opened »immediately« after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

Note

The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.

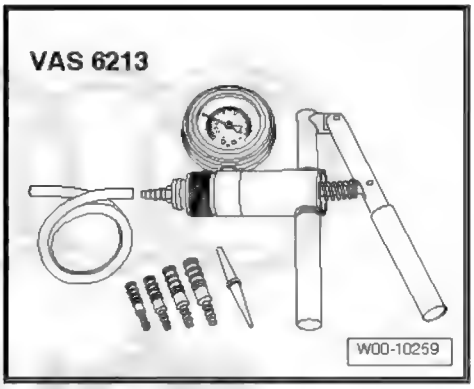
Additional steps required

– Erase event memory and generate readiness code in engine control unit in „Guided Functions“ mode.

1.8 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:
- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Lines porous or leaking

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If an entry is stored in the event memory, check the vacuum lines leading to the corresponding component and also check the other vacuum lines leading to other components.

– If it is not possible to build up pressure with the hand vacuum pump -VAS 6213- or if the pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

2 Injection system

Overview

2.1 Technical data

Engine data		2.0 ltr. turbo FSI engine
Idling speed (cannot be adjusted; is regulated by idling speed stabilisation)		640 ... 800 rpm
Maximum rpm governed by deactivation of fuel injectors		6500 rpm
Fuel pressure	Initial fuel pressure up to high-pressure pump (generated according to requirements by electric fuel pump in fuel tank)	3,0 ... 10.5 bar
	Fuel high-pressure (generated by mechanical single-plunger pump)	30 ... 150 bar

2.2 Overview of fitting locations - injection system (CAEB, CDNB and CDZA)

Components A to G are not shown in the overview.

1 - Lambda probe -G39- and Lambda probe heater -Z19-

- ❑ Fitting location ⇒ page 22
- ❑ Removing and installing ⇒ page 75

2 - Electrical connector

- ❑ For Lambda probe -G39- and Lambda probe heater -Z19-
- ❑ Fitting location ⇒ page 22

3 - Lambda probe after catalytic converter -G130- and Lambda probe heater 1 after catalytic converter -Z29-

- ❑ Fitting location ⇒ page 22
- ❑ Removing and installing ⇒ page 75

4 - Fuel pressure regulating valve -N276-

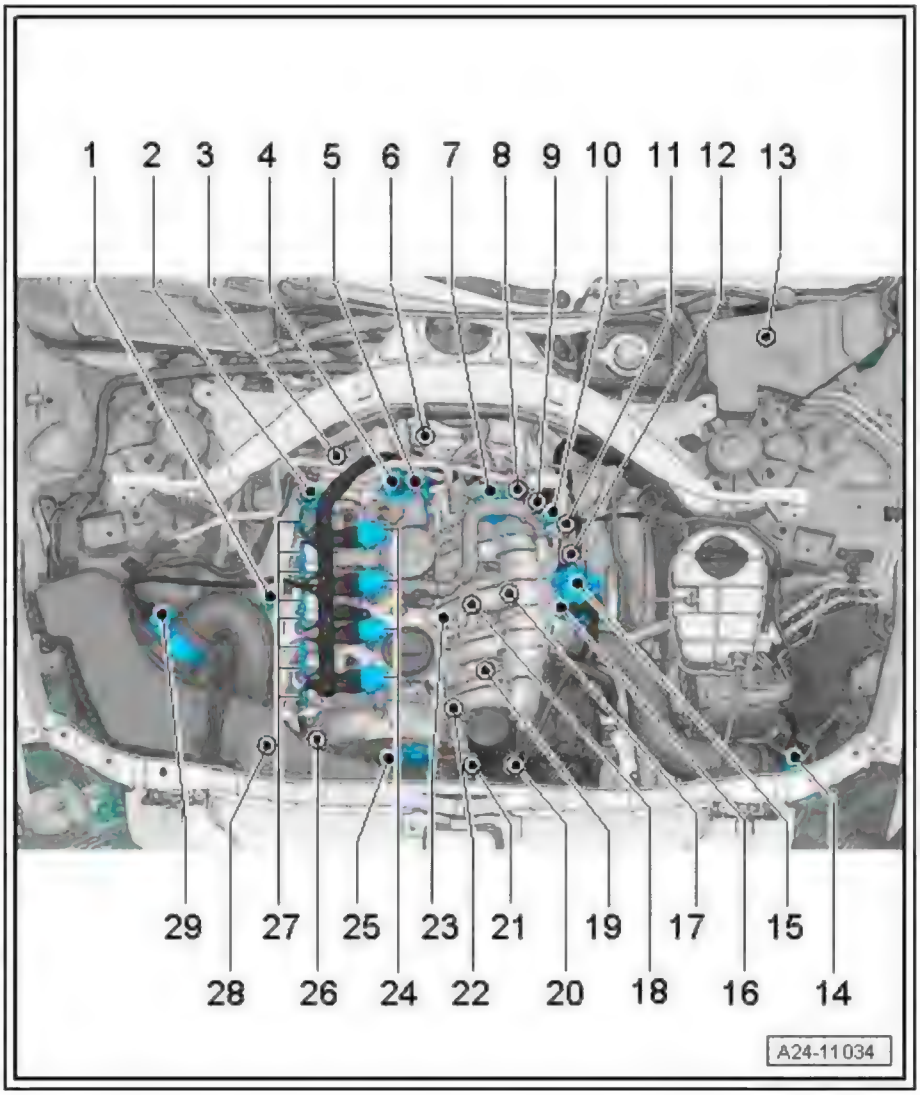
- ❑ Fitting location ⇒ page 20

5 - High-pressure pump

- ❑ Removing and installing ⇒ page 20

6 - Electrical connector

- ❑ Lambda probe after catalytic converter -G130- and Lambda probe heater 1 after catalytic



converter -Z29-

- ❑ Fitting location ⇒ page 22

7 - Vacuum unit for intake manifold flaps (air flow control flaps)

- ❑ Fitting location ⇒ page 19

8 - Intake manifold flap valve -N316-

- ❑ Fitting location ⇒ page 19

9 - Engine speed sender -G28-

- ❑ Fitting location ⇒ page 20
- ❑ 4.5 Nm

10 - Activated charcoal filter solenoid valve 1 -N80-

11 - Electrical connectors

- ❑ For knock sensor 1 -G61- , intake manifold flap valve -N316- , fuel pressure sender -G247- , intake manifold flap potentiometer -G336- , coolant temperature sender -G62- , Hall sender -G40- and injectors N30...N33
- ❑ Fitting location ⇒ page 20

12 - Continued coolant circulation pump -V51-

- ❑ Only installed on vehicles for hot countries
- ❑ Fitting location ⇒ page 20
- ❑ Removing and installing ⇒ Rep. gr. 19

13 - Engine control unit -J623-

- ❑ Fitting location ⇒ page 17
- ❑ Removing and installing ⇒ page 80

14 - Charge pressure sender -G31-

- ❑ Fitting location ⇒ page 21
- ❑ Removing and installing ⇒ Rep. gr. 21

15 - Throttle valve module -J338- , throttle valve drive (electric throttle operation) -G186-

- ❑ Throttle valve drive angle sender 1 -G187- and throttle valve drive angle sender 2 -G188-
- ❑ Throttle valve module -J338- must always be re-adapted to engine control unit -J623- after removal and installation or if it has been renewed. Use ⇒ Vehicle diagnostic tester
- ❑ Fitting location ⇒ page 21

16 - Intake air temperature sender -G42-

- ❑ Fitting location ⇒ page 21

17 - Coolant temperature sender -G62-

- ❑ Fitting location ⇒ page 21
- ❑ Removing and installing ⇒ Rep. gr. 19

18 - Knock sensor 1 -G61-

- ❑ To remove, first remove coolant pump with thermostat
- ❑ Tightening torque: 20 Nm
- ❑ Removing and installing ⇒ page 88

19 - Fuel pressure sender -G247-

- ❑ Fitting location ⇒ page 19
- ❑ Removing and installing ⇒ page 66

20 - Oil pressure switch -F22- and oil pressure switch for reduced oil pressure -F378-

- ❑ Fitting location ⇒ page 18
- ❑ Removing and installing ⇒ Rep. gr. 17

21 - Valve for oil pressure control -N428-
- ❑ Fitting location ⇒ page 18
- ❑ Removing and installing ⇒ Rep. gr. 17

22 - Intake manifold flap potentiometer -G336-
- ❑ Fitting location ⇒ page 19

23 - Hall sender -G40-
- ❑ Fitting location ⇒ page 19

24 - Ignition coils with output stages
- ❑ Fitting location ⇒ page 18
- ❑ Puller -T40039- is required for removing ignition coils from cylinder head.
- ❑ Removing and installing ⇒ page 86

25 - Camshaft control valve 1 -N205-
- ❑ Fitting location ⇒ page 21
- ❑ Removing and installing ⇒ Rep. gr. 15

26 - Turbocharger air recirculation valve -N249-
- ❑ Located directly on turbocharger ⇒ page 22
- ❑ Removing and installing ⇒ Rep. gr. 21

26 - Actuators for camshaft adjustment
- ❑ Actuator 1 for camshaft adjustment -F366-
- ❑ Actuator 2 for camshaft adjustment -F367-
- ❑ Actuator 3 for camshaft adjustment -F368-
- ❑ Actuator 4 for camshaft adjustment -F369-
- ❑ Actuator 5 for camshaft adjustment -F370-
- ❑ Actuator 6 for camshaft adjustment -F371-
- ❑ Actuator 7 for camshaft adjustment -F372-
- ❑ Actuator 8 for camshaft adjustment -F373-
- ❑ Fitting location ⇒ page 18
- ❑ Removing and installing ⇒ Rep. gr. 15

28 - Charge pressure control solenoid valve -N75-
- ❑ Located directly on turbocharger ⇒ page 22
- ❑ Removing and installing ⇒ Rep. gr. 21

29 - Air mass meter -G70-
- ❑ Removing and installing ⇒ page 66

A - Brake light switch - F- and brake pedal switch -F47-
- ❑ Fitting location ⇒ page 17
- ❑ In footwell on brake pedal
- ❑ Removing and installing ⇒ Rep. gr. 45

B - Clutch position sender -G476-
- ❑ Only fitted on vehicles with manual gearbox
- ❑ Fitting location ⇒ page 17

C - Accelerator position sender -G79- and accelerator position sender 2 -G185-
- ❑ Fitting location ⇒ page 17
- ❑ On accelerator pedal (both senders are accommodated in one housing)
- ❑ Removing and installing ⇒ Rep. gr. 20

D - Fuel pump control unit -J538-
- ❑ Removing and installing ⇒ Rep. gr. 20

E - Radiator fan control unit -J293-

- ❑ Incorporated in radiator fan

F - Injectors

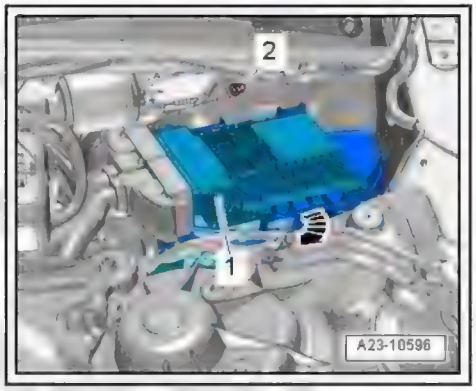
- ❑ Injector, cylinder 1 -N30-
- ❑ Injector, cylinder 2 -N31-
- ❑ Injector, cylinder 3 -N32-
- ❑ Injector, cylinder 4 -N33-
- ❑ Removing and installing ⇒ page 56

G - Left electrohydraulic engine mounting solenoid valve -N144-

- ❑ Not installed in all vehicles (depends on gearbox type)

Engine control unit -J623-

- ♦ In left electronics box in engine compartment



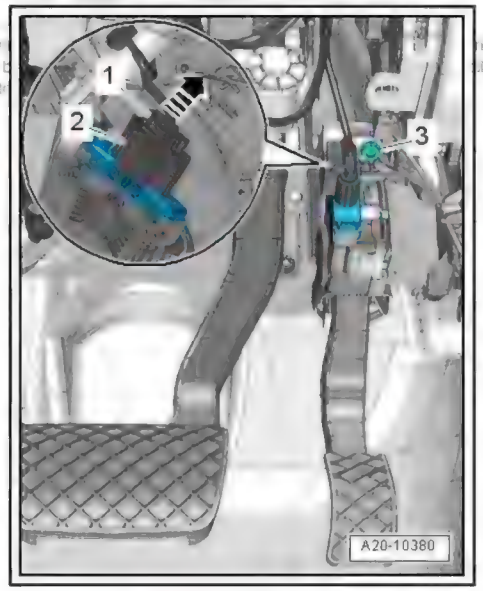
Accelerator position sender -G79- and accelerator position sender 2 -G185-

2 - Electrical connector

Note

The accelerator position sender -G79- and accelerator position sender 2 -G185- are integrated in the accelerator pedal module and cannot be renewed individually.

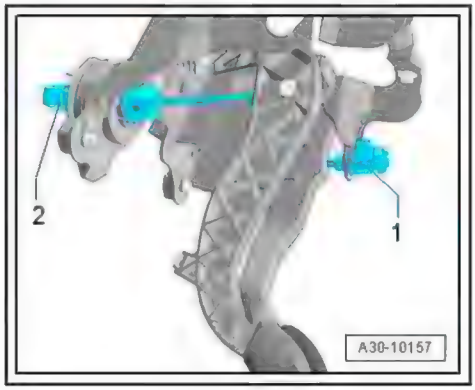
Removing and installing ⇒ Rep. gr. 20



Fitting location of brake light switch -F- and brake pedal switch -F47- / clutch position sender -G476-

1 - Brake light switch -F- and brake pedal switch -F47-

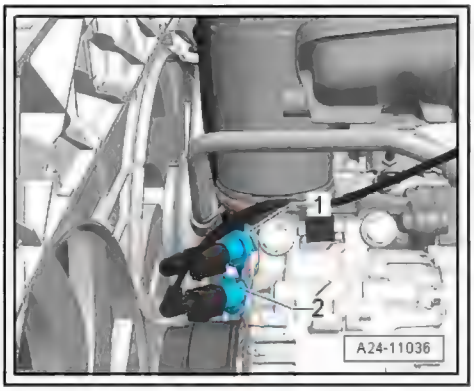
2 - Clutch position sender -G476- with clutch pedal switch for engine start -F194- and clutch pedal switch -F36- (manual gearbox only)



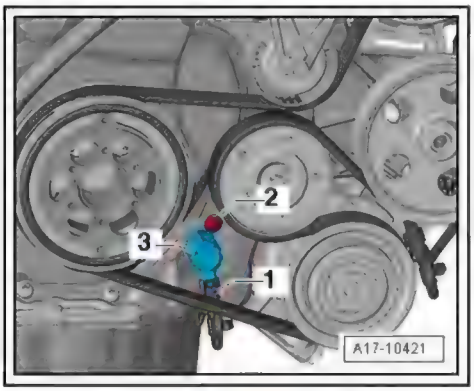
Oil pressure switch

1 - Oil pressure switch for reduced oil pressure -F378-

2 - Oil pressure switch -F22-



Valve for oil pressure control -N428- -3-



Ignition coils and actuators for camshaft adjustment

1 - Ignition coil 1 with output stage -N70-

2 - Ignition coil 2 with output stage -N127-

3 - Ignition coil 3 with output stage -N291-

4 - Ignition coil 4 with output stage -N292-

5 - Actuator 2 for camshaft adjustment -F367- (for cylinder No. 1)

6 - Actuator 1 for camshaft adjustment -F366- (for cylinder No. 1)

7 - Actuator 3 for camshaft adjustment -F368- (for cylinder No. 2)

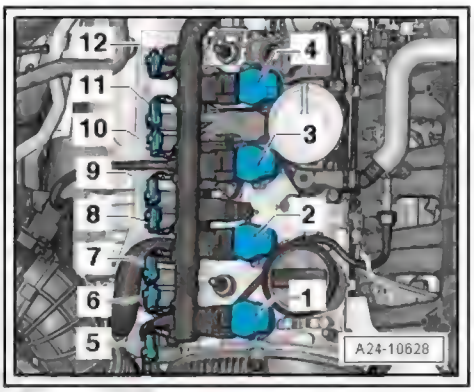
8 - Actuator 4 for camshaft adjustment -F369- (for cylinder No. 2)

9 - Actuator 6 for camshaft adjustment -F371- (for cylinder No. 3)

10 - Actuator 5 for camshaft adjustment -F370- (for cylinder No. 3)

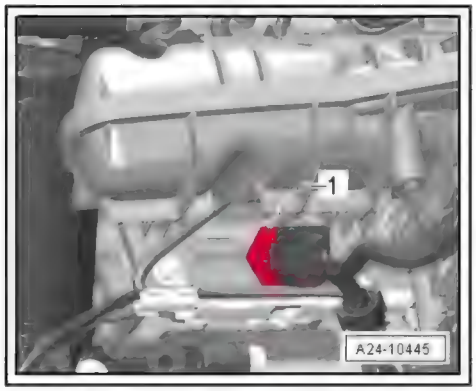
11 - Actuator 7 for camshaft adjustment -F372- (for cylinder No. 4)

12 - Actuator 8 for camshaft adjustment -F373- (for cylinder No. 4)



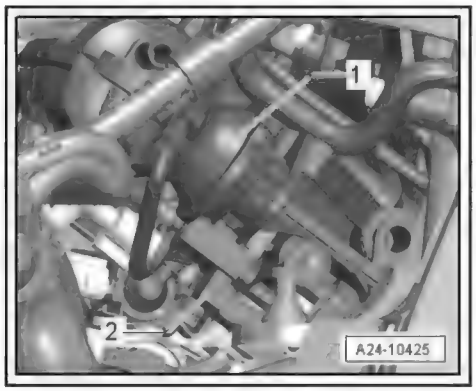
Fuel pressure sender -G247- -1-

- Make sure that connecting piece is tightened to specified torque „25 Nm“ before installing fuel pressure sender -G247-

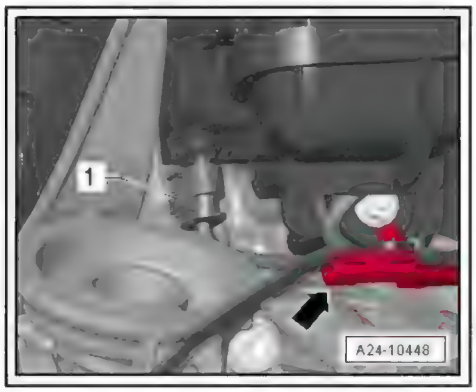


Intake manifold flap valve -N316- -2-

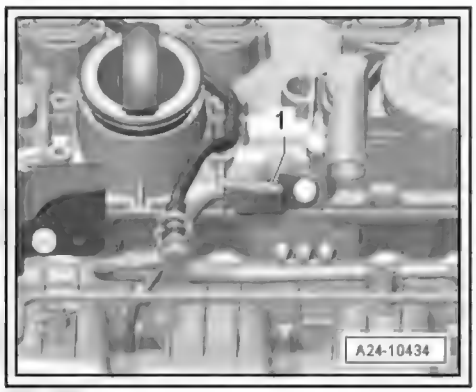
1 - Vacuum unit for intake manifold flaps



Intake manifold flap potentiometer -G336- -1-



Hall sender -G40- -1-



Electrical connectors

1 - From activated charcoal filter solenoid valve 1 -N80-

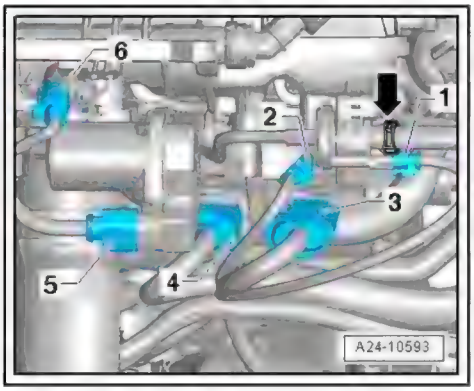
2 - From knock sensor 1 -G61-

3 - (14-pin) from intake manifold flap valve -N316- , fuel pressure sender -G247- , intake manifold flap potentiometer -G336- , coolant temperature sender -G62- and Hall sender -G40-

4 - (8-pin) from injectors -N30-...-N33-

5 - From throttle valve module -J338-

6 - From intake air temperature sender -G42-

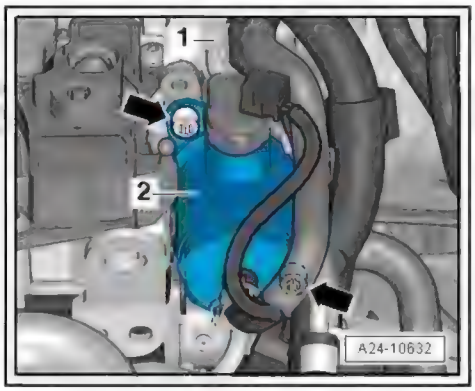


High-pressure pump

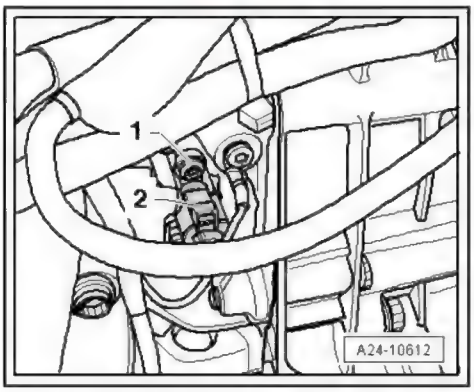
1 - Fuel pressure regulating valve -N276-

2 - High-pressure pump

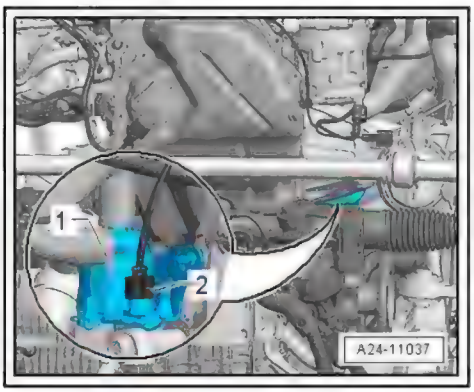
- -Arrows- denote securing bolts



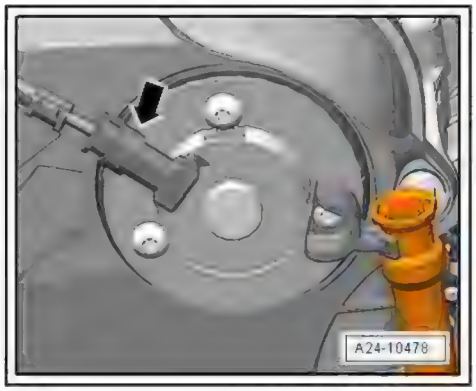
Engine speed sender -G28- -2-



Continued coolant circulation pump -V51- -1-



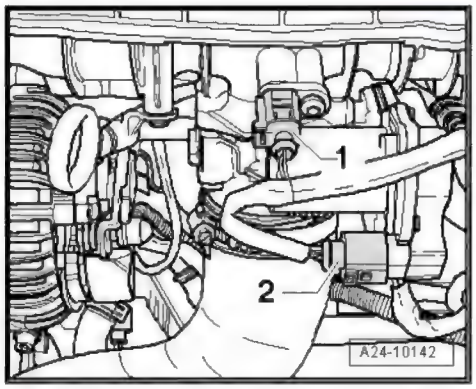
Camshaft control valve 1 -N205- -arrow-



Components

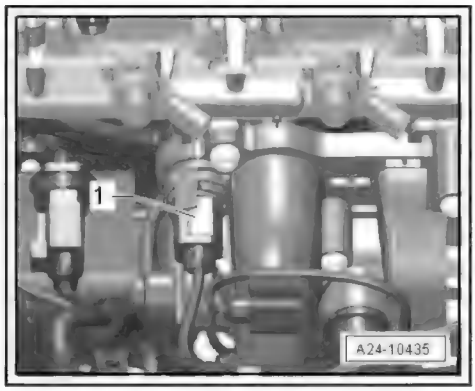
1 - Intake air temperature sender -G42-

2 - Throttle valve module -J338-



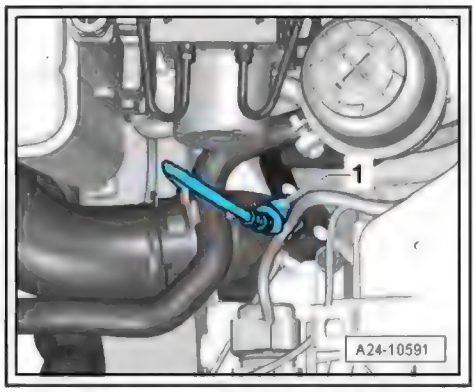
Coolant temperature sender -G62- -1-

Fitting location: below intake manifold in coolant pump



Charge pressure sender -G31- -1-

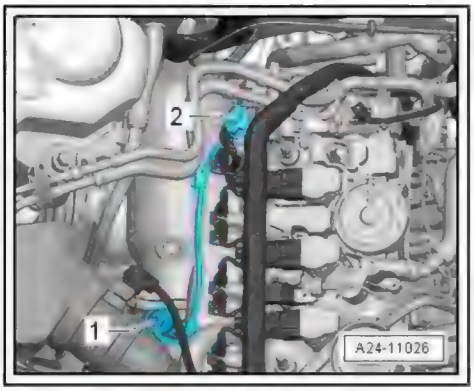
Removing and installing ⇒ Rep. gr. 21



Lambda probe

1 - Lambda probe -G39- and Lambda probe heater -Z19-

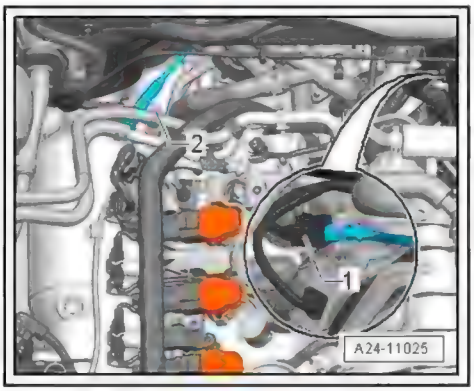
2 - Electrical connector for Lambda probe -G39-



Lambda probe

1 - Electrical connector for Lambda probe after catalytic converter -G130-

2 - Lambda probe after catalytic converter -G130- and Lambda probe heater 1 after catalytic converter -Z29-



Components on turbocharger

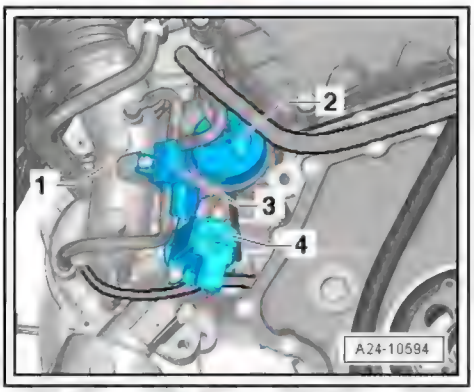
1 - Turbocharger

2 - Vacuum unit for turbocharger; checking, adjusting, removing and installing ⇒ Rep. gr. 21

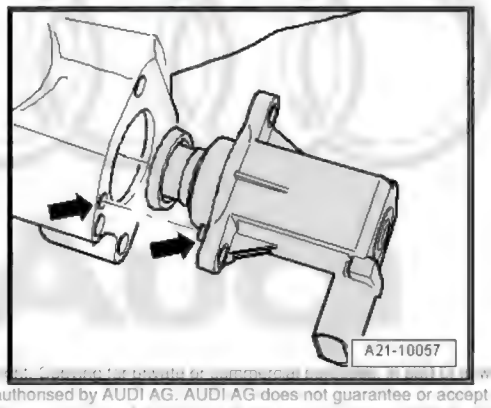
3 - Charge pressure control solenoid valve -N75-

4 - Turbocharger air recirculation valve -N249- (note installation position, refer to next illustration)

For removing and installing components on turbocharger, refer to ⇒ Rep. gr. 21 .



Pay attention to installation position of turbocharger air recirculation valve -N249-



2.3 Overview of fitting locations - injection system (vehicles with hybrid drive - CHJA)

1 - Lambda probe -G39- and Lambda probe heater -Z19-

- ❑ Fitting location ⇒ page 31
- ❑ Removing and installing ⇒ page 75

2 - 6-pin connector

- ❑ For Lambda probe -G39- and Lambda probe heater -Z19-
- ❑ Fitting location ⇒ page 31

3 - Lambda probe after catalytic converter -G130- and Lambda probe heater 1 after catalytic converter -Z29-

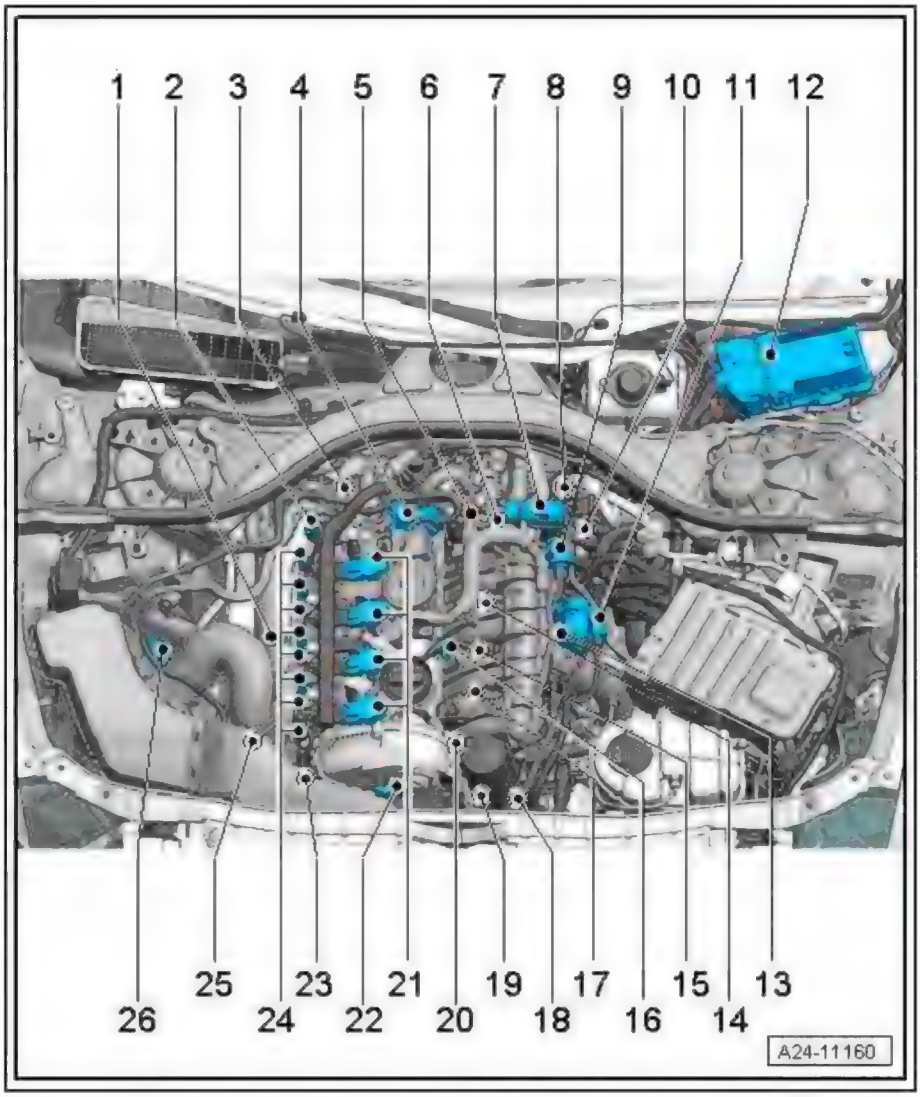
- ❑ Fitting location ⇒ page 31
- ❑ Removing and installing ⇒ page 75

4 - High-pressure pump

- ❑ With fuel pressure regulating valve -N276-
- ❑ Fitting location ⇒ page 29
- ❑ Removing and installing ⇒ page 63

5 - Vacuum unit for air flow control flaps (intake manifold flaps)

- ❑ Fitting location



⇒ page 28

6 - Intake manifold flap valve -N316-

- Fitting location ⇒ page 28

7 - Pressure sensor for activated charcoal filter system -G804-

- Fitting location ⇒ page 31

8 - Engine speed sender -G28-

- Fitting location ⇒ page 30
- 4.5 Nm

9 - Activated charcoal filter solenoid valve 1 -N80-

10 - Electrical connectors

- For knock sensor 1 -G61- , intake manifold flap valve -N316- , fuel pressure sender -G247- , intake manifold flap potentiometer -G336- , coolant temperature sender -G62- , Hall sender -G40- and injectors N30...N33
- Fitting location ⇒ page 29

11 - Throttle valve module -J338- , throttle valve drive (electric throttle operation) -G186-

- Throttle valve drive angle sender 1 -G187- and throttle valve drive angle sender 2 -G188-
- Throttle valve module -J338- must always be re-adapted to engine control unit -J623- after removal and installation or if it has been renewed. Use ⇒ Vehicle diagnostic tester

12 - Engine control unit -J623-

- Fitting location ⇒ page 26
- Removing and installing ⇒ page 80

13 - Intake air temperature sender -G42-

- Fitting location ⇒ page 29

14 - Knock sensor 1 -G61-

- To remove, first remove coolant pump with thermostat
- Tightening torque: 20 Nm
- Removing and installing ⇒ page 88

15 - Coolant temperature sender -G62-

- Fitting location ⇒ page 31
- Removing and installing ⇒ Rep. gr. 19

16 - Hall sender -G40-

- Fitting location ⇒ page 29

17 - Fuel pressure sender -G247-

- Fitting location ⇒ page 28
- Removing and installing ⇒ page 66

18 - Oil pressure switch for reduced oil pressure -F378- and oil pressure switch -F22-

- Fitting location ⇒ page 27
- Removing and installing ⇒ Rep. gr. 17

19 - Valve for oil pressure control -N428-

- Fitting location ⇒ page 27
- Removing and installing ⇒ Rep. gr. 17

20 - Intake manifold flap potentiometer -G336-

- Fitting location ⇒ page 29

21 - Ignition coils with output stages

- Fitting location ⇒ page 28
- Puller -T40039- is required for removing ignition coils from cylinder head.
- Removing and installing ⇒ page 86

22 - Camshaft control valve 1 -N205-
- ❑ Fitting location ⇒ page 30
- ❑ Removing and installing ⇒ Rep. gr. 15

23 - Turbocharger air recirculation valve -N249-
- ❑ Located directly on turbocharger
- ❑ Fitting location ⇒ page 32
- ❑ Removing and installing ⇒ Rep. gr. 21

24 - Actuators for camshaft adjustment
- ❑ Actuator 1 for camshaft adjustment -F366-
- ❑ Actuator 2 for camshaft adjustment -F367-
- ❑ Actuator 3 for camshaft adjustment -F368-
- ❑ Actuator 4 for camshaft adjustment -F369-
- ❑ Actuator 5 for camshaft adjustment -F370-
- ❑ Actuator 6 for camshaft adjustment -F371-
- ❑ Actuator 7 for camshaft adjustment -F372-
- ❑ Actuator 8 for camshaft adjustment -F373-
- ❑ Fitting location ⇒ page 28
- ❑ Removing and installing ⇒ Rep. gr. 15

29 - Charge pressure control solenoid valve -N75-
- ❑ Located directly on turbocharger
- ❑ Fitting location ⇒ page 32
- ❑ Removing and installing ⇒ Rep. gr. 21

26 - Air mass meter -G70-
- ❑ Removing and installing ⇒ page 66

A - Brake light switch - F- and brake pedal switch -F47-
- ❑ Fitting location ⇒ page 27
- ❑ In footwell on brake pedal
- ❑ Removing and installing ⇒ Rep. gr. 45

B - Clutch position sender -G476-
- ❑ Only fitted on vehicles with manual gearbox
- ❑ Fitting location ⇒ page 27

C - Accelerator position sender -G79- and accelerator position sender 2 -G185-
- ❑ Fitting location ⇒ page 27
- ❑ On accelerator pedal (both senders are accommodated in one housing)
- ❑ Removing and installing ⇒ Rep. gr. 20

D - Fuel pump control unit -J538-
- ❑ Fitting location ⇒ page 26
- ❑ Removing and installing ⇒ Rep. gr. 20

E - Secondary air pump motor -V101-
- ❑ Removing and installing ⇒ Rep. gr. 26

F - Radiator fan control unit -J293-
- ❑ Incorporated in radiator fan

G - Injectors

- ❑ Injector, cylinder 1 -N30-
- ❑ Injector, cylinder 2 -N31-
- ❑ Injector, cylinder 3 -N32-
- ❑ Injector, cylinder 4 -N33-
- ❑ Removing and installing ⇒ page 56

H - Secondary air inlet valve -N112- and sender 1 for secondary air pressure -G609-

- ❑ Removing and installing ⇒ Rep. gr. 26

I - Charge pressure sender -G31-

- ❑ Fitting location ⇒ page 30
- ❑ Removing and installing ⇒ Rep. gr. 21

J - Left electrohydraulic engine mounting solenoid valve -N144-

- ❑ Not installed in all vehicles (depends on gearbox type)
- ❑ Removing and installing ⇒ Rep. gr. 10

K - Coolant pump for high-temperature circuit -V467-

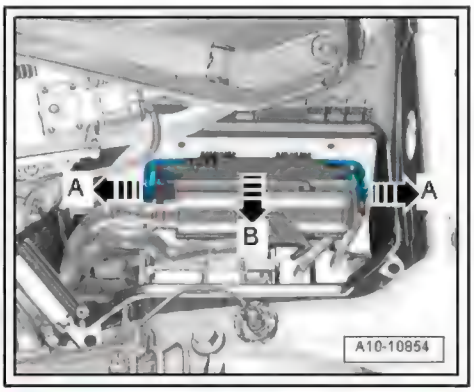
- ❑ Removing and installing ⇒ Rep. gr. 19

L - Continued coolant circulation pump -V51-

- ❑ Fitting location ⇒ page 30
- ❑ Removing and installing ⇒ Rep. gr. 19

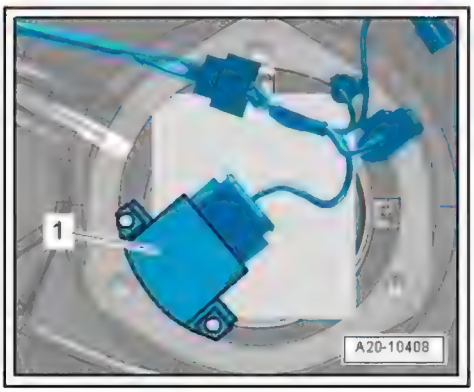
Engine control unit -J623-

- ♦ In left electronics box in engine compartment



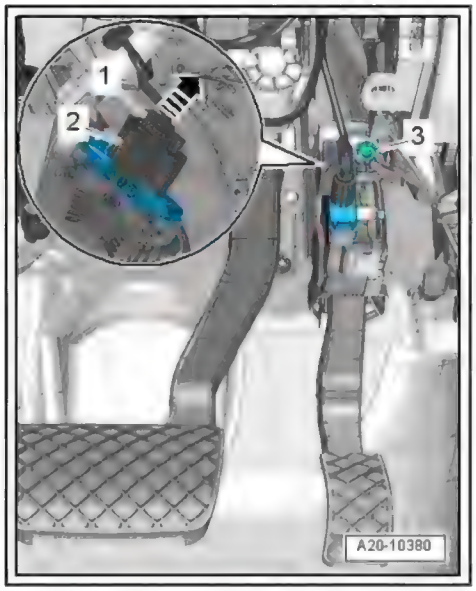
Fuel pump control unit -J538- -1-

Removing and installing ⇒ Rep. gr. 20



Accelerator position sender -G79- and accelerator position sender 2 -G185-

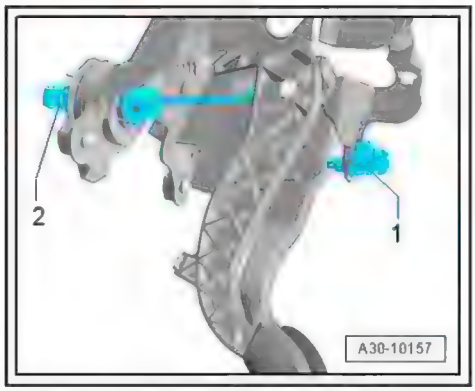
2 - Electrical connector



Clutch position sender -G476- -2-

Integrated functions: clutch pedal switch for engine start -F194- and clutch pedal switch -F36- (manual gearbox only)

1 - Brake light switch -F- and brake pedal switch -F47-

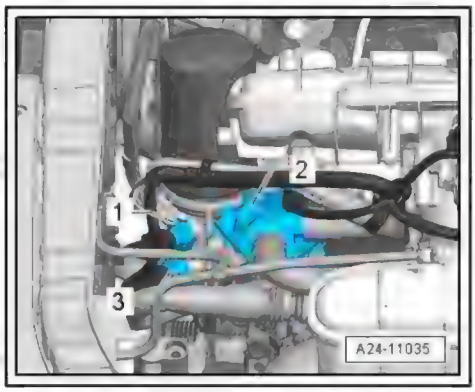


Oil pressure switches and coolant pump

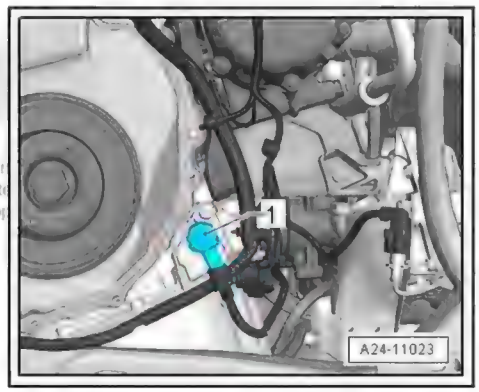
1 - Oil pressure switch for reduced oil pressure -F378-

2 - Continued coolant circulation pump -V51-

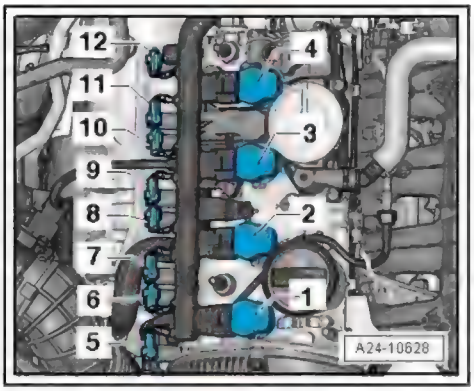
3 - Oil pressure switch -F22-



Valve for oil pressure control -N428- -1-



Ignition coils and actuators for camshaft adjustment



1 - Ignition coil 1 with output stage -N70-

2 - Ignition coil 2 with output stage -N127-

3 - Ignition coil 3 with output stage -N291-

4 - Ignition coil 4 with output stage -N292-

5 - Actuator 2 for camshaft adjustment -F367- (for cylinder No. 1)

6 - Actuator 1 for camshaft adjustment -F366- (for cylinder No. 1)

7 - Actuator 3 for camshaft adjustment -F368- (for cylinder No. 2)

8 - Actuator 4 for camshaft adjustment -F369- (for cylinder No. 2)

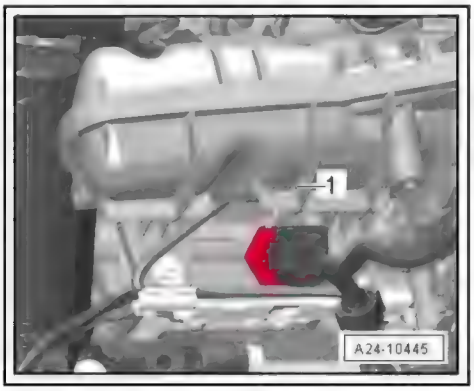
9 - Actuator 6 for camshaft adjustment -F371- (for cylinder No. 3)

10 - Actuator 5 for camshaft adjustment -F370- (for cylinder No. 3)

11 - Actuator 7 for camshaft adjustment -F372- (for cylinder No. 4)

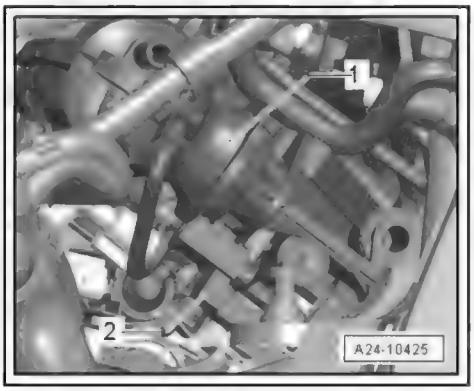
12 - Actuator 8 for camshaft adjustment -F373- (for cylinder No. 4)

Fuel pressure sender -G247- -1-



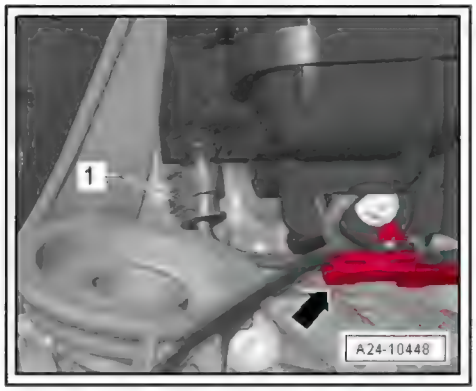
- Make sure that connecting piece is tightened to specified torque „25 Nm“ before installing fuel pressure sender -G247-

Intake manifold flap valve -N316- -2-

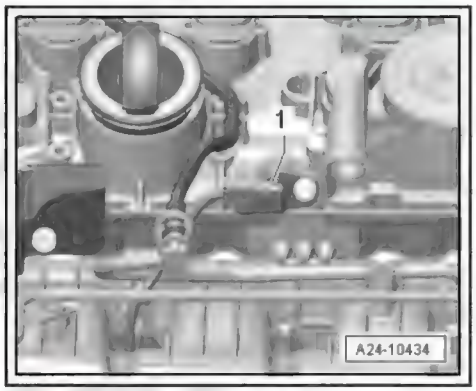


1 - Vacuum unit for intake manifold flaps

Intake manifold flap potentiometer -G336- -1-



Hall sender -G40- -1-



Electrical connectors

1 - From activated charcoal filter solenoid valve 1 -N80-

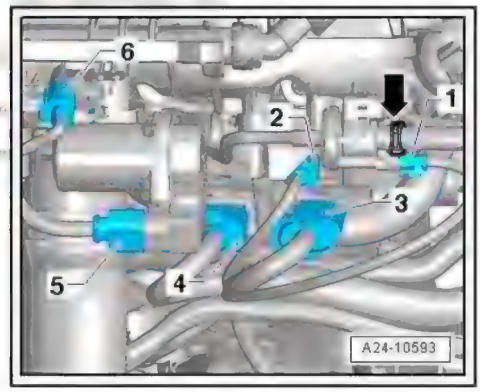
2 - From knock sensor 1 -G61-

3 - (14-pin) from intake manifold flap valve -N316- , fuel pressure sender -G247- , intake manifold flap potentiometer -G336- , coolant temperature sender -G62- and Hall sender -G40-

4 - (8-pin) from injectors -N30-...-N33-

5 - From throttle valve module -J338-

6 - From intake air temperature sender -G42-

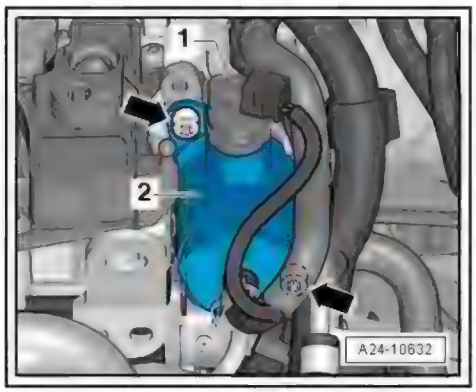


High-pressure pump

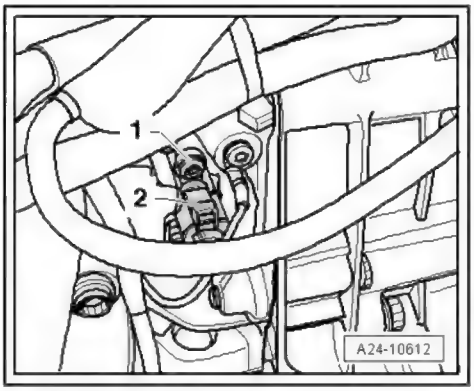
1 - Fuel pressure regulating valve -N276-

2 - High-pressure pump

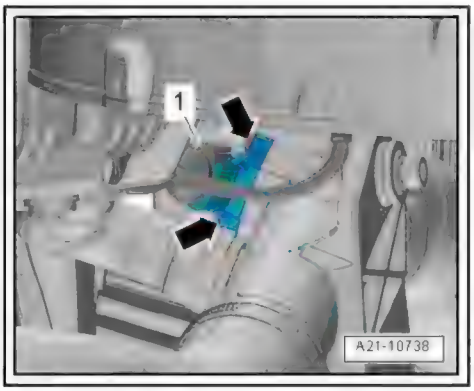
- -Arrows- denote securing bolts



Engine speed sender -G28- -2-



Charge pressure sender -G31-

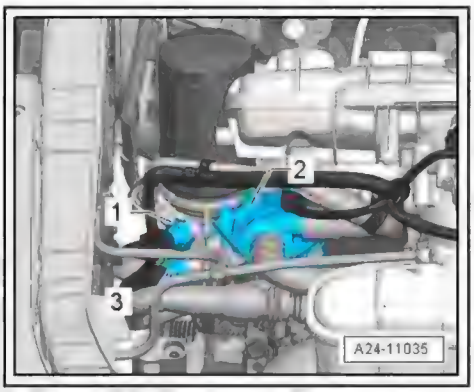


Continued coolant circulation pump -V51- -2-

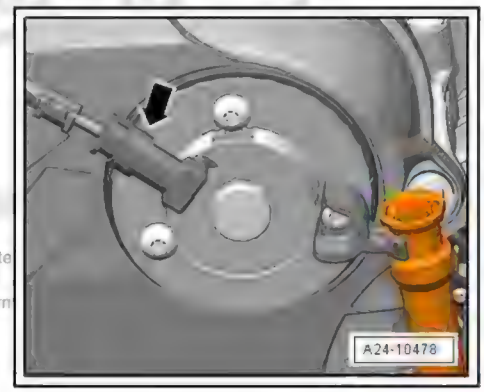
1 - Oil pressure switch for reduced oil pressure -F378-

2 - Continued coolant circulation pump -V51-

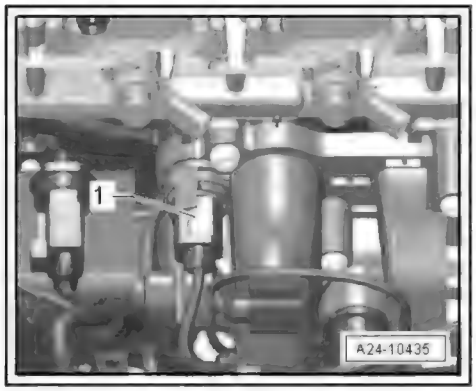
3 - Oil pressure switch -F22-



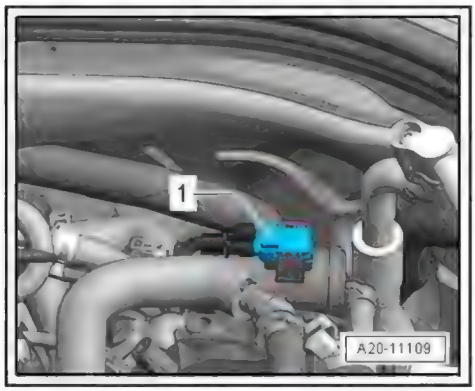
Camshaft control valve 1 -N205- -arrow-



Coolant temperature sender -G62- -1-



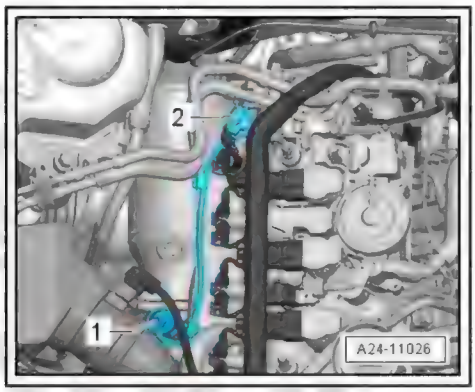
Pressure sensor for activated charcoal filter system -G804- -1-



Lambda probe

1 - Lambda probe -G39-

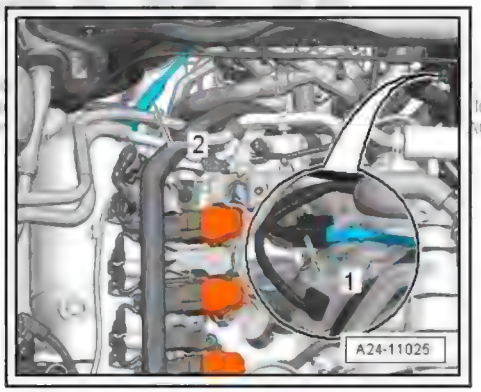
2 - Electrical connector for Lambda probe -G39-



Lambda probe

1 - Electrical connector for Lambda probe after catalytic converter -G130-

2 - Lambda probe after catalytic converter -G130-



Components on turbocharger

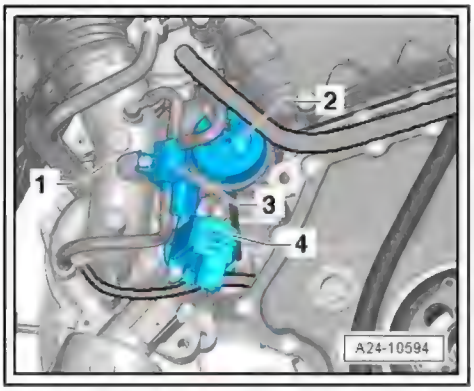
1 - Turbocharger

2 - Vacuum unit for turbocharger; checking, adjusting, removing and installing ⇒ Rep. gr. 21

3 - Charge pressure control solenoid valve -N75-

4 - Turbocharger air recirculation valve -N249- (note installation position, refer to next illustration)

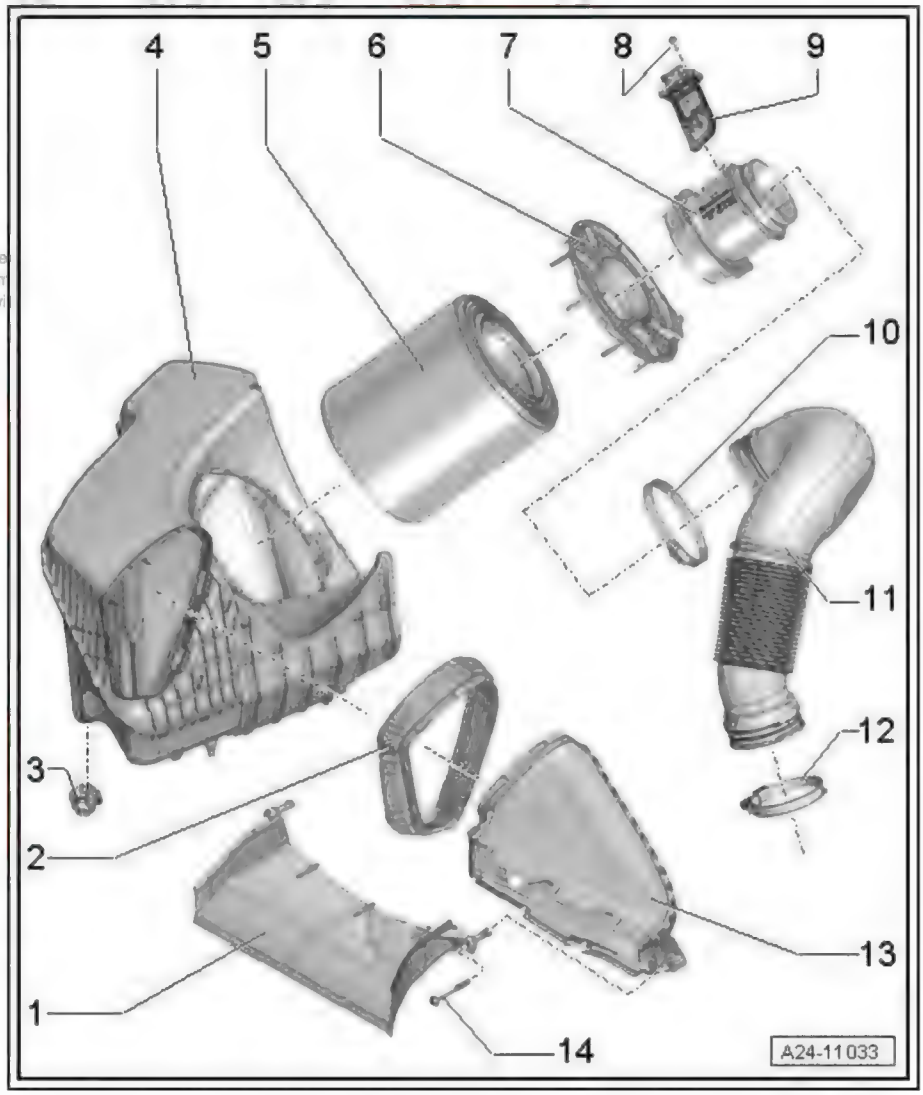
For removing and installing components on turbocharger, refer to ⇒ Rep. gr. 21 .



3 Air cleaner

Overview

3.1 Exploded view - air cleaner housing



1 - Air duct
- ❑ Clean out salt deposits, dirt and leaves, etc.

2 - Sealing element

3 - Retainer
- ❑ For air cleaner housing

4 - Air cleaner housing
- ❑ Clean out salt deposits, dirt and leaves, etc.
- ❑ Removing and installing ⇒ „3.4 Removing and installing air cleaner housing“, page 36

5 - Air filter element
- ❑ Use genuine air filter element ⇒ Electronic parts catalogue
- ❑ Change intervals ⇒ Maintenance tables
- ❑ Removing and installing ⇒ „3.3 Removing and installing air filter element“, page 34

6 - Cover
- ❑ For air cleaner housing
- ❑ Clean out salt deposits and dirt

7 - Housing for air mass meter -G70-

8 - Bolt

9 - Air mass meter -G70-
- ❑ Removing and installing ⇒ page 66

10 - Screw-type clip
- ❑ Tightening torque ⇒ page 34

11 - Air pipe

12 - Screw-type clip
- ❑ Tightening torque ⇒ page 34

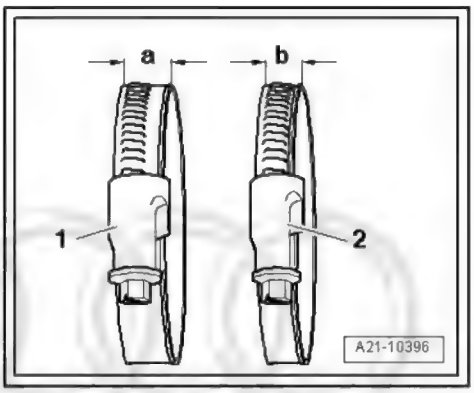
13 - Air duct

- ❑ Clean out salt deposits, dirt and leaves, etc.

14 - Bolt

- ❑ 1.5 Nm

Installing air pipes and hoses with screw-type clips



Note

- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Secure all hose connections with the correct type of screw-type clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *To ensure that the air hoses can be properly secured at their connections, spray rust remover onto the worm thread of used hose clips before installing.*

Tightening torque for

1 - Screw-type clip -a- = 13 mm wide: 5.5 Nm

2 - Screw-type clip -b- = 9 mm wide: 3.4 Nm

3.2 Removing and installing engine cover panel

Removing

– Pull engine cover panel carefully off retaining pins. Do not jerk the cover panel away, and do not try to pull on one side only.

Installing

– To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.

– Position engine cover panel on engine (note locations of oil filler neck and oil dipstick).

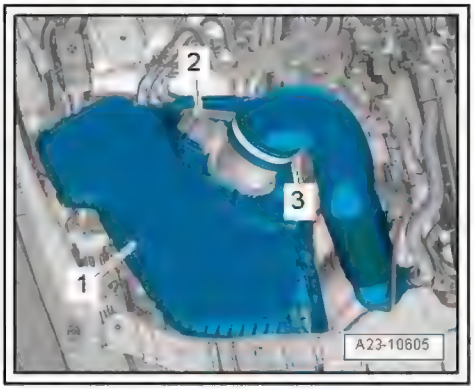
– Press engine cover panel with both hands into the rubber grommets.

3.3 Removing and installing air filter element

Removing

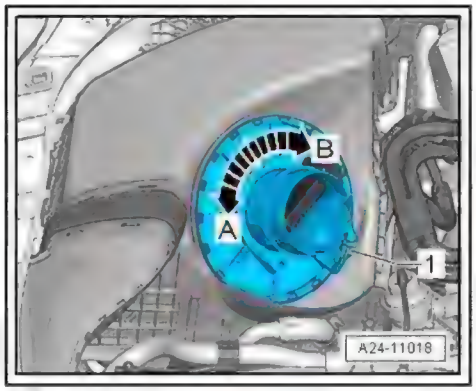
– Unplug electrical connector -2- at air mass meter -G70- .

– Open hose clip -3- at air hose and disconnect air hose at air mass meter -G70- .



– Release catch -1-, turn cover for air cleaner housing in anti-clockwise direction -arrow A- and detach.

– Take out air filter element.



Installing

- Tightening torque ⇒ page 33

To ensure that the air mass meter -G70- functions properly, it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *The air cleaner housing MUST be clean.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue.*
- *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Observe environmental requirements for disposal.*

– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.

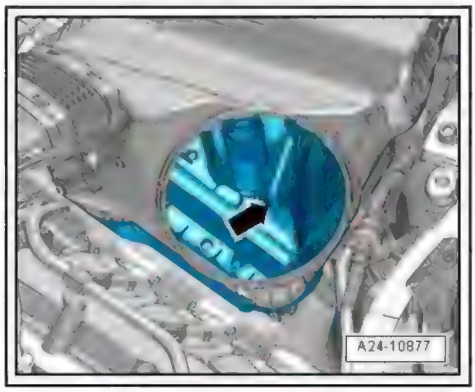
– Blow out water drain -arrow- with compressed air.

– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).

– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

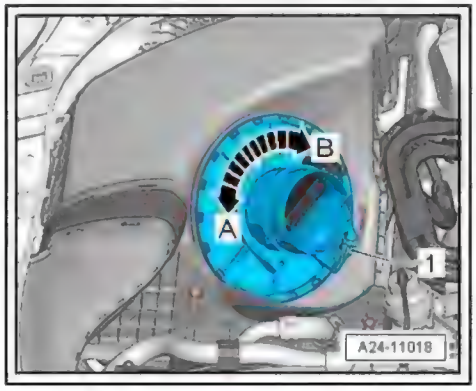
– When installing air filter element, check that it is properly centred in retainer in air cleaner housing.

– Carefully fit cover on air cleaner housing without using force.



– Turn cover in clockwise direction -arrow B- until catch -1- engages.

– Ensure secure fit of intake hose at air mass meter -G70- .



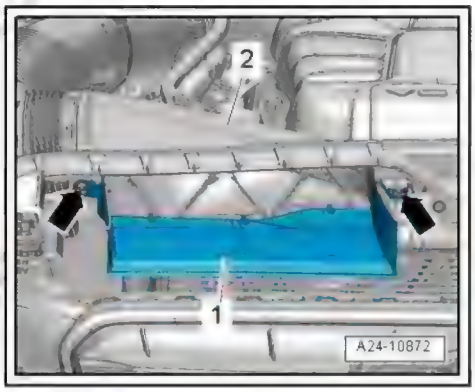
The remaining installation steps are carried out in the reverse sequence.

3.4 Removing and installing air cleaner housing

Removing

– Remove lock carrier cover ⇒ Rep. gr. 63 .

– Remove bolts -arrows- and detach air duct -2-.



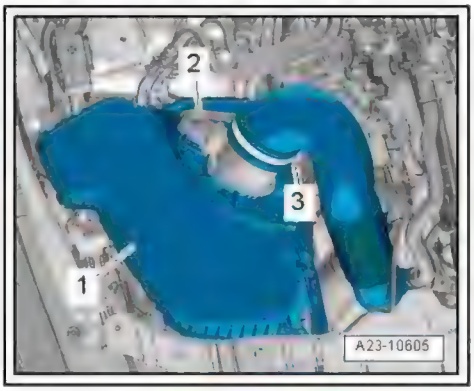
Note

Disregard -item 1-.

– Unplug electrical connector -2- at air mass meter -G70- .

– Open hose clip -3- at air hose and disconnect air hose at air mass meter -G70- .

– Lift out air cleaner housing -1-.



Installing

To ensure the proper function of the air mass meter -G70- it is important to observe the following instructions.

Note

- *The air cleaner housing MUST be clean.*
- *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Check water drain hose in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).

– Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.

– Check for salt residue, dirt and leaves in air hose (engine intake side).

– Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

– Re-install air cleaner housing.

– Ensure secure fit of air hose at air mass meter -G70- .

The remaining installation steps are carried out in the reverse sequence.

– Install lock carrier cover ⇒ Rep. gr. 63 .

4 Intake manifold

Overview

4.1 Exploded view - intake manifold

1 - Screw for intake air temperature sender -G42-
- ❑ 9 Nm

2 - Intake air temperature sender -G42-

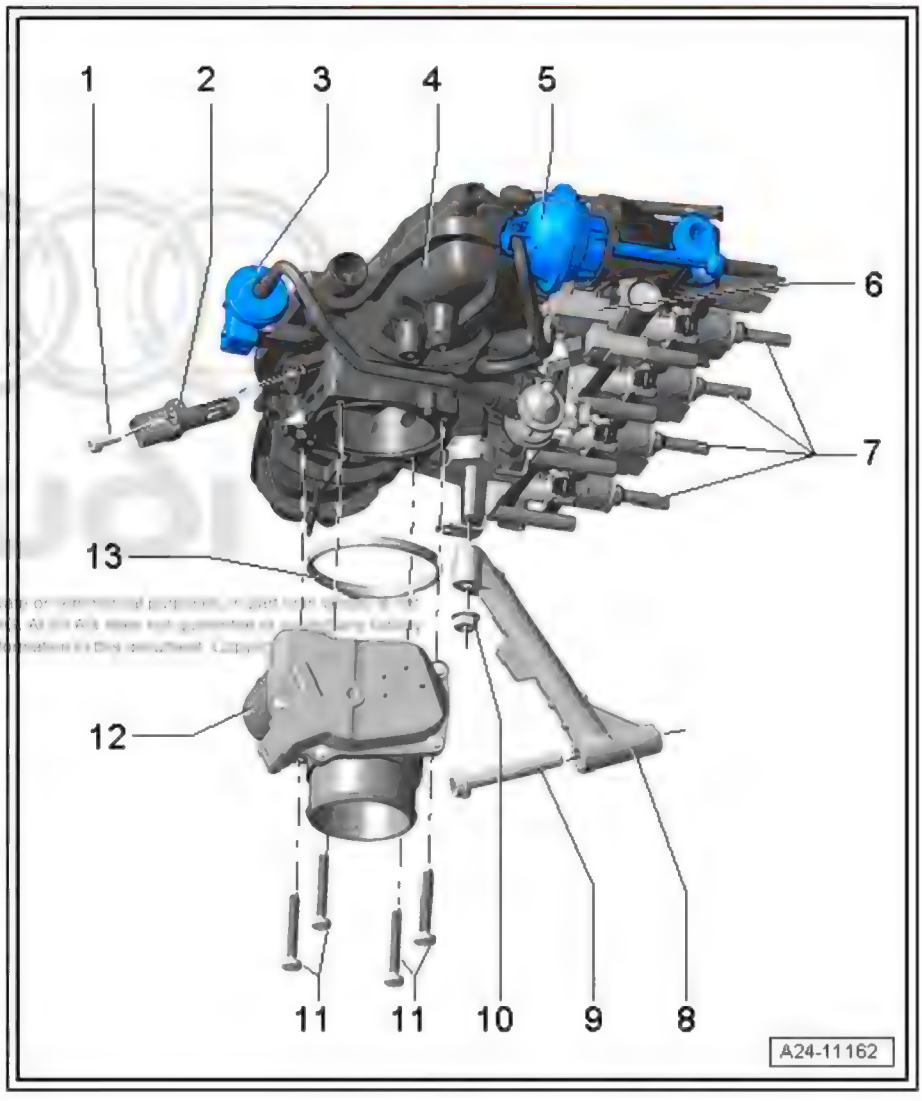
- Activated charcoal filter solenoid valve 1 -N80-
- ❑ With dual non-return valve; checking ⇒ page 72

4 - Intake manifold
- ❑ Removing and installing (CAEB, CDNB and CDZA) ⇒ page 38
- ❑ Removing and installing (vehicles with hybrid drive - CHJA) ⇒ page 42
- ❑ 10 Nm

5 - Vacuum unit for air flow control flaps (intake manifold flaps)

6 - Intake manifold flap valve - N316-

7 - Injectors
- ❑ Renew O-ring and teflon ring
- ❑ Ensure correct installation position.
- ❑ Removing and installing



⇒ page 56

8 - Intake manifold support

9 - Bolt for intake manifold support
- ❑ 23 Nm

10 - Securing nut for intake manifold support
- ❑ 10 Nm

11 - Bolts for throttle valve module -J338-
- ❑ 9 Nm

12 - Throttle valve module -J338- , throttle valve drive for electric throttle -G186-
- ❑ Throttle valve drive angle sender 1 for electric throttle -G187- and throttle valve drive angle sender 2 for electric throttle -G188-
- ❑ Throttle valve module -J338- must be re-adapted to engine control unit -J623- after it has been removed, installed or renewed; see „Guided Functions“ using ⇒ Vehicle diagnostic tester

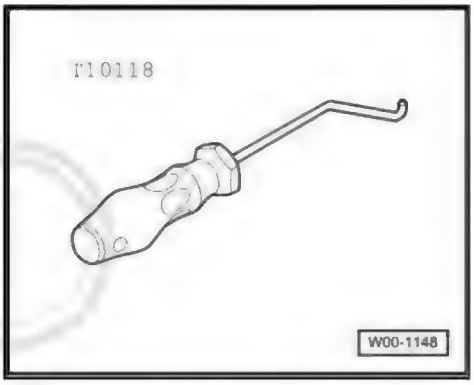
13 - Seal
- ❑ Renew

4.2 Removing and installing intake manifold (CAEB, CDNB and CDZA)

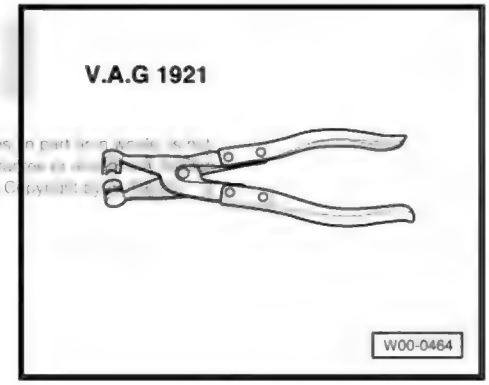
After the fuel rail has been removed or renewed, intake manifold flap potentiometer -G336- must be adapted to engine control unit -J623- . Use ⇒ Vehicle diagnostic tester in „Guided Functions“ mode.

Special tools and workshop equipment required

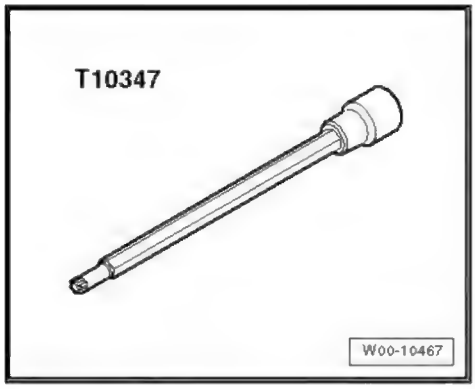
- ♦ Assembly tool -T10118-



- ♦ Hose clip pliers -V.A.G 1921-



♦ Socket Torx T30 -T10347-



Note

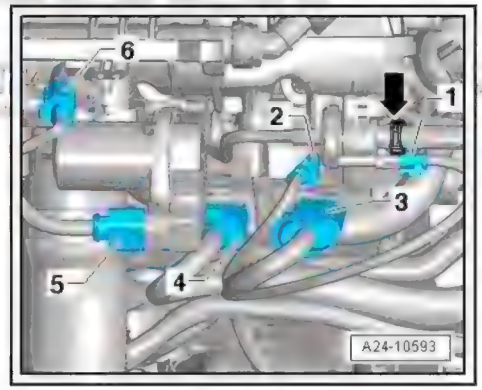
♦ *In order to reach the injectors, first remove the intake manifold with the fuel rail.*

♦ *The combustion chamber ring seal (teflon) and the O-ring must be renewed.*

WARNING

The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ page 8 .

– Disconnect negative terminal from battery.
– Remove engine cover panel ⇒ page 34 .
– Disconnect vacuum line -arrow- leading to activated charcoal filter.
– Unplug following electrical connectors:



1 - Activated charcoal filter solenoid valve 1 -N80-

2 - From knock sensor 1 -G61-

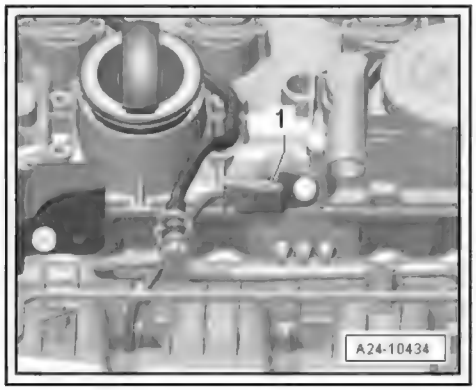
3 - From intake manifold flap valve -N316- , fuel pressure sender -G247- and Hall sender -G40-

4 - From injectors

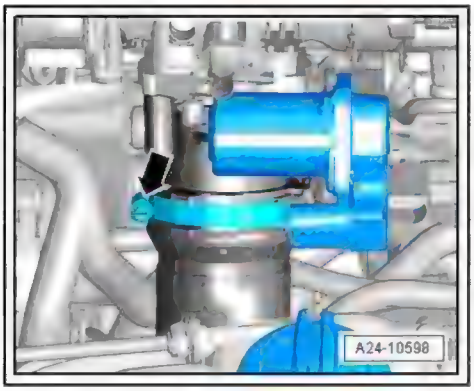
5 - Throttle valve module -J338-

6 - Intake air temperature sender -G42-

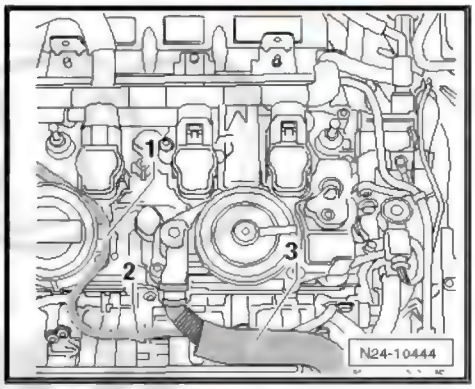
Unplug electrical connector -1- at Hall sender -G40- .



– Open hose clip -arrow- securing air intake hose and disconnect hose downwards from throttle valve module -J338- .

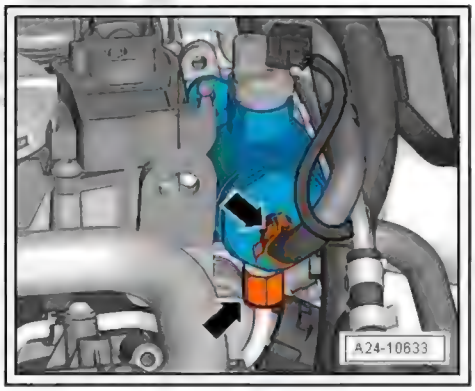


– Disconnect vacuum line -1- at connection -2-.
– Remove crankcase breather hose -3-.



Note

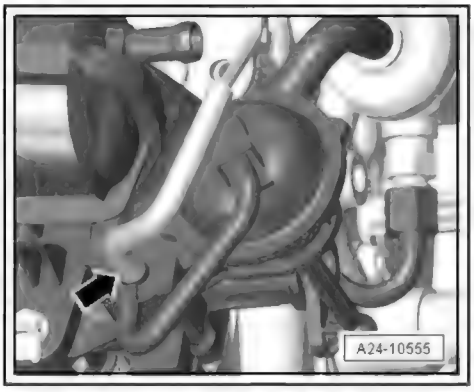
– Release spring-type clip -top arrow- and detach fuel supply hose from high-pressure pump.
– Unscrew union nut for high-pressure fuel pipe -bottom arrow- at high-pressure pump.



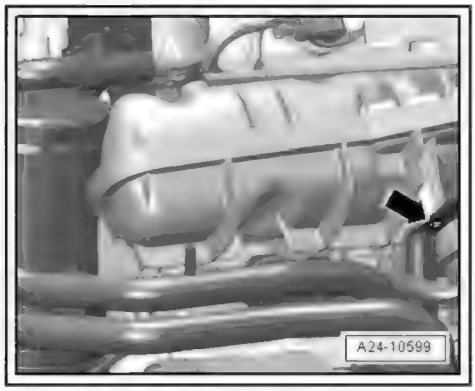
Note

- *The fuel system must not be under pressure.*
- *Use a clean cloth to catch escaping fuel.*
- *Seal off open connections with clean caps. It is essential to ensure that no dirt enters the fuel system.*

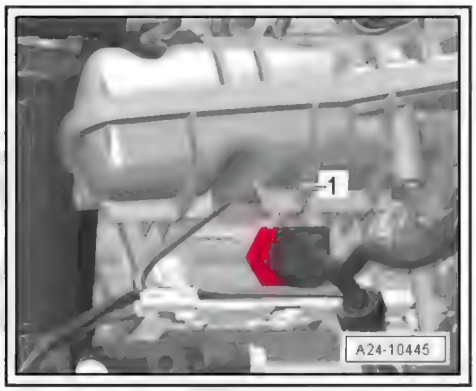
– Disconnect vacuum line -arrow- at intake manifold flap valve - N316- .



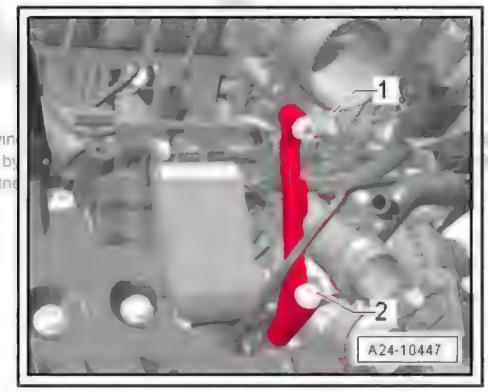
– Remove bolt -arrow- for coolant line from intake manifold.



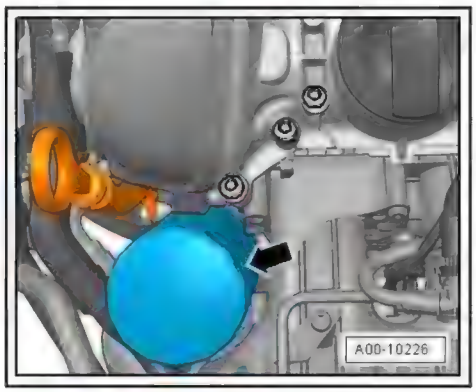
– Unplug electrical connector at fuel pressure sender -G247- -1-.



– Slightly loosen securing nut -1- and remove bolt -2-.



– Loosen oil filter with Hazet strap wrench -2171-1- or with oil filter tool -3417- and remove oil filter.
– Unscrew bolts from intake manifold using socket Torx T30 - T10347- .

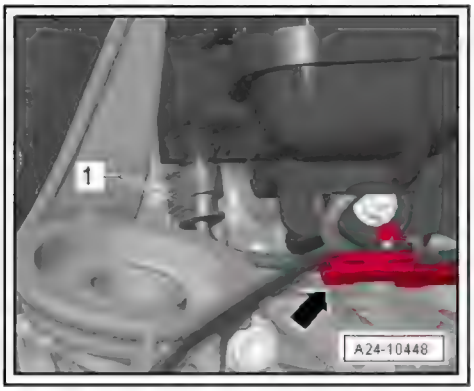


Note

To remove the bolts that cannot be accessed if you do not have socket Torx T30 -T10347- , the throttle valve module -J338- must be removed.

– Carefully pull intake manifold and fuel rail slightly away from cylinder head.

– Unplug electrical connector -1- from intake manifold flap potentiometer -G336- and then detach intake manifold.



Note

- *The injectors can remain in the fuel rail.*
- *Block off intake ports with a clean cloth.*

– Disconnect intake manifold from fuel rail ⇒ page 50 .

Installing

Note

Make sure that injectors are installed correctly.

– Fit intake manifold onto studs (left and right) on cylinder head.
– The remaining installation steps are carried out in the reverse sequence.

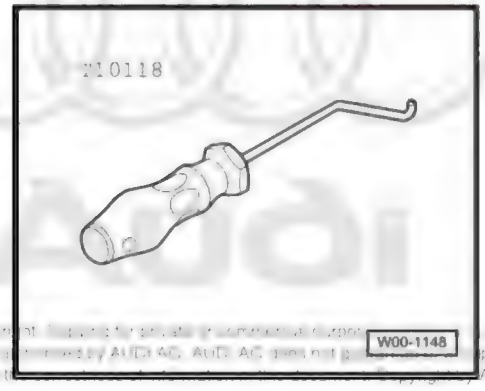
- Tightening torque: ⇒ page 37
- Tightening torque:
⇒ „4.4 Exploded view - fuel rail“, page 48

4.3 Removing and installing intake manifold (vehicles with hybrid drive - CHJA)

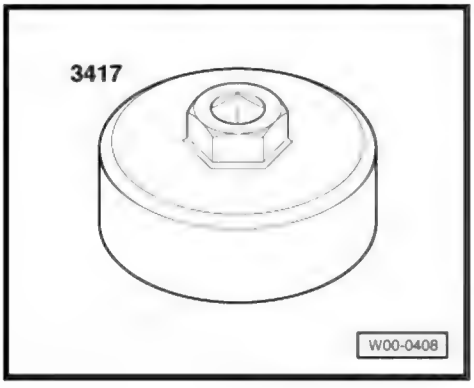
After the fuel rail has been removed or renewed, intake manifold flap potentiometer -G336- must be adapted to engine control unit -J623- . Use ⇒ Vehicle diagnostic tester in „Guided Functions“ mode.

Special tools and workshop equipment required

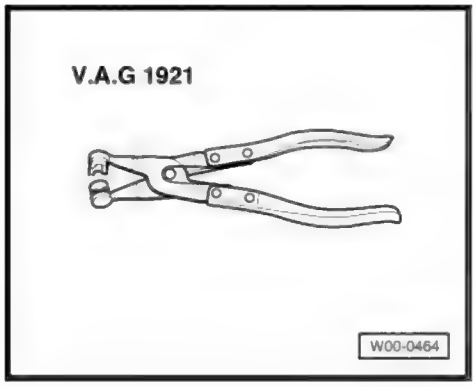
- Assembly tool -T10118-



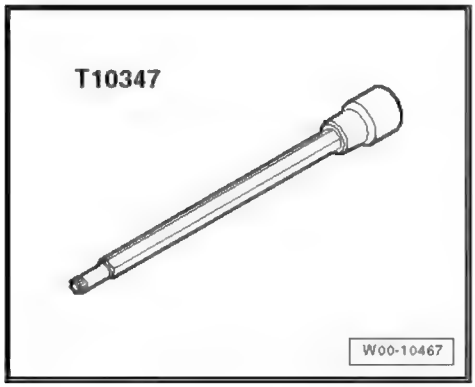
- Oil filter tool -3417-



- Hose clip pliers -V.A.G 1921-



- Socket Torx T30 -T10347-



Safety precautions and repair instructions for vehicles with hybrid drive

DANGER!

Risk of fatal injury if high-voltage components are damaged.

Observe the following when working in the vicinity of high-voltage components or wiring:

- *It is not permitted to use cutting or forming tools, other sharp-edged tools or heat sources such as welding, brazing, soldering, hot air or thermal bonding equipment.*
- *Before starting work, visually inspect the high-voltage components in the areas involved.*
- *Before working in the engine compartment, visually inspect the power and control electronics for electric drive -JX1- , electric drive motor -V141- , air conditioner compressor -V470- and high-voltage wiring.*
- *Before working on the vehicle underbody, visually inspect the high-voltage wiring and covers.*
- *Before working on the rear section of the vehicle, visually inspect the high-voltage wiring and the electro-box with the maintenance connector for high-voltage system - TW - .*
- *Visually inspect all potential equalisation lines.*

Check the following when making the visual inspection:

- *There must be no external damage on any component.*
- *The insulation of the high-voltage wiring and potential equalisation lines must not be damaged.*
- *There must be no unusual deformation of the high-voltage wiring.*
- *All high-voltage components must be identified by a red warning sticker.*

WARNING

Working on vehicles with high-voltage wiring:

- *Do not support yourself or tools on high-voltage wiring or associated components --> this can damage the insulation.*
- *High-voltage wiring must not be excessively bent or kinked --> this can damage the insulation.*
- *The round high-voltage connectors are colour-coded with an external coloured ring and are provided with mechanical coding or guide lugs. It is important to observe this coding when joining up the round high-voltage connectors, otherwise the connectors can be damaged.*

Removing

Note

- *In order to reach the injectors, first remove the intake manifold with the fuel rail.*
- *The combustion chamber ring seal (teflon) and the O-ring must be renewed.*

> WARNING
>
> *The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ page 8 .*

– Disconnect negative terminal from battery.

– Remove engine cover panel ⇒ page 34 .

– Disconnect vacuum line -arrow- leading to activated charcoal filter.

– Unplug following electrical connectors:

1 - Activated charcoal filter solenoid valve 1 -N80-

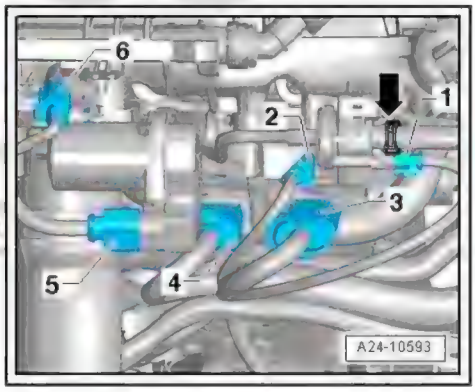
2 - From knock sensor 1 -G61-

3 - From intake manifold flap valve -N316-, fuel pressure sender -G247- and Hall sender -G40-

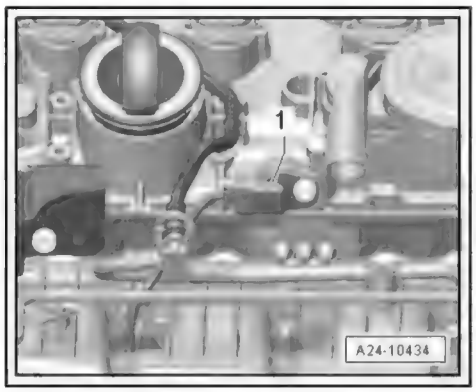
4 - From injectors

5 - Throttle valve module -J338-

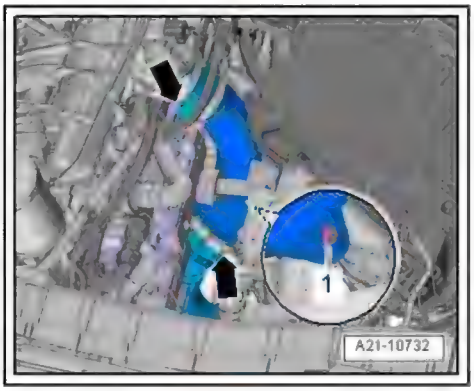
6 - Intake air temperature sender -G42-



Unplug electrical connector -1- at Hall sender -G40- .

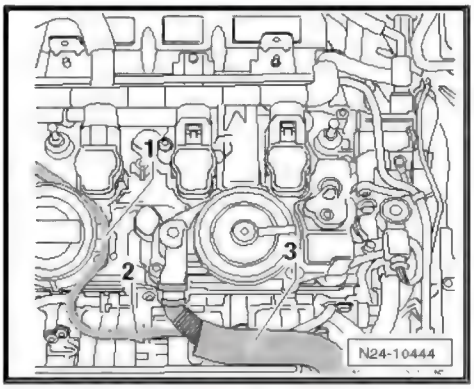


– Loosen hose clips -arrows-.
– Unscrew bolt -1- and detach air pipe.



– Disconnect vacuum line -1- at connection -2-.
– Remove crankcase breather hose -3-.

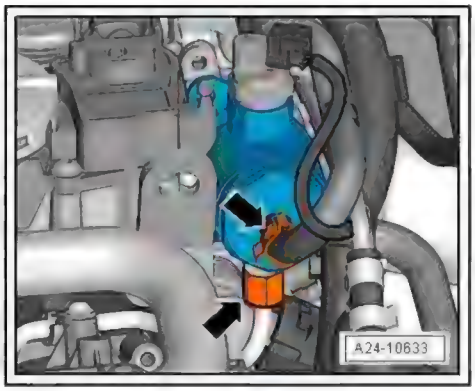
Note



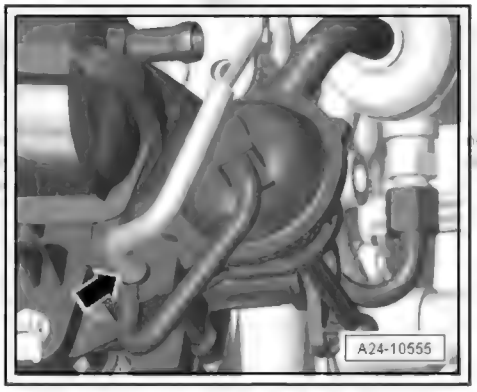
– Release spring-type clip -top arrow- and detach fuel supply hose from high-pressure pump.
– Unscrew union nut for high-pressure fuel pipe -bottom arrow- at high-pressure pump.

Note

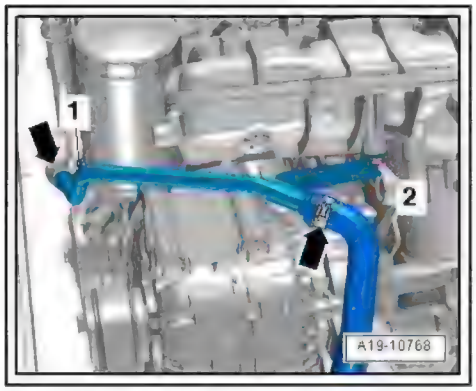
- *The fuel system must not be under pressure.*
- *Use a clean cloth to catch escaping fuel.*
- *Seal off open connections with clean caps. It is essential to ensure that no dirt enters the fuel system.*



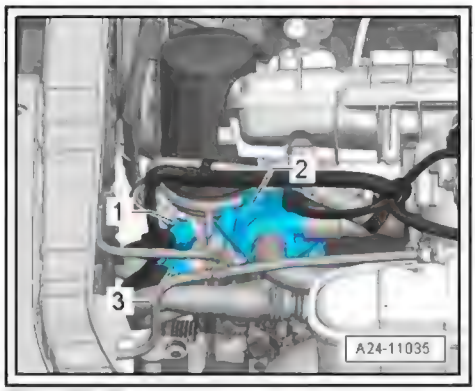
– Disconnect vacuum line -arrow- at intake manifold flap valve -N316- .



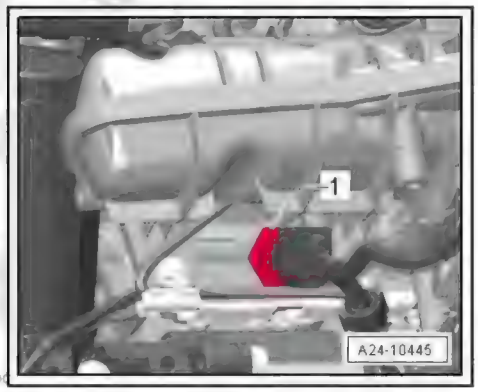
– Remove bolts -1 and 2- for coolant line.



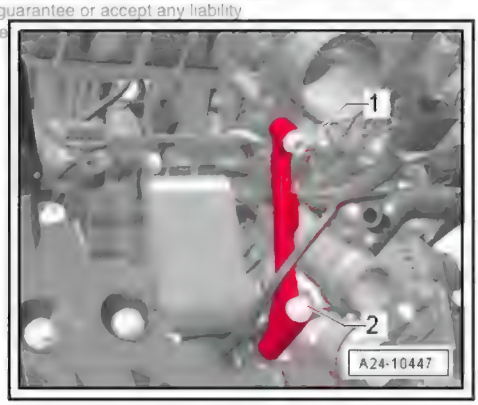
– Remove continued coolant circulation pump -V51- -2-.



– Unplug electrical connector at fuel pressure sender -G247- -1-.
– Detach air conditioner compressor (electrically powered) from bracket ⇒ Air conditioning; Rep. gr. 87 .

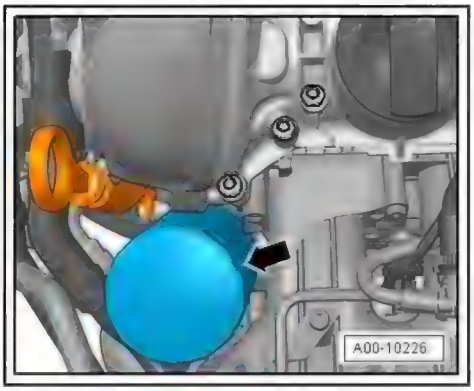


– Slightly loosen securing nut -1- and remove bolt -2-.



– Loosen oil filter with oil filter tool -3417- and remove oil filter.

– Unscrew bolts from intake manifold using socket Torx T30 - T10347- .

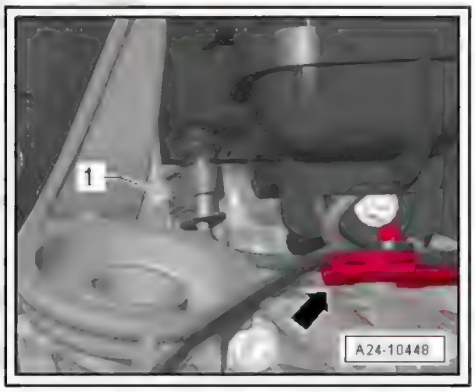


Note

To remove the bolts that cannot be accessed if you do not have socket Torx T30 -T10347- , the throttle valve module -J338- must be removed.

– Carefully pull intake manifold and fuel rail slightly away from cylinder head.

– Unplug electrical connector -1- from intake manifold flap potentiometer -G336- and then detach intake manifold.



Note

- *The injectors can remain in the fuel rail.*
- *Block off intake ports with a clean cloth.*

– Disconnect intake manifold from fuel rail ⇒ page 50 .

Installing

Note

Make sure that injectors are installed correctly.

– Fit intake manifold onto studs (left and right) on cylinder head.

– The remaining installation steps are carried out in the reverse sequence.

- Tightening torque:
⇒ „4.1 Exploded view - intake manifold“, page 37
- Tightening torque:
⇒ „4.4 Exploded view - fuel rail“, page 48

4.4 Exploded view - fuel rail

1 - Injector

- ❑ With combustion chamber ring seal (teflon ring seal): always renew
- ❑ Renew O-rings
- ❑ Ensure correct installation position.
- ❑ Removing and installing ⇒ page 56

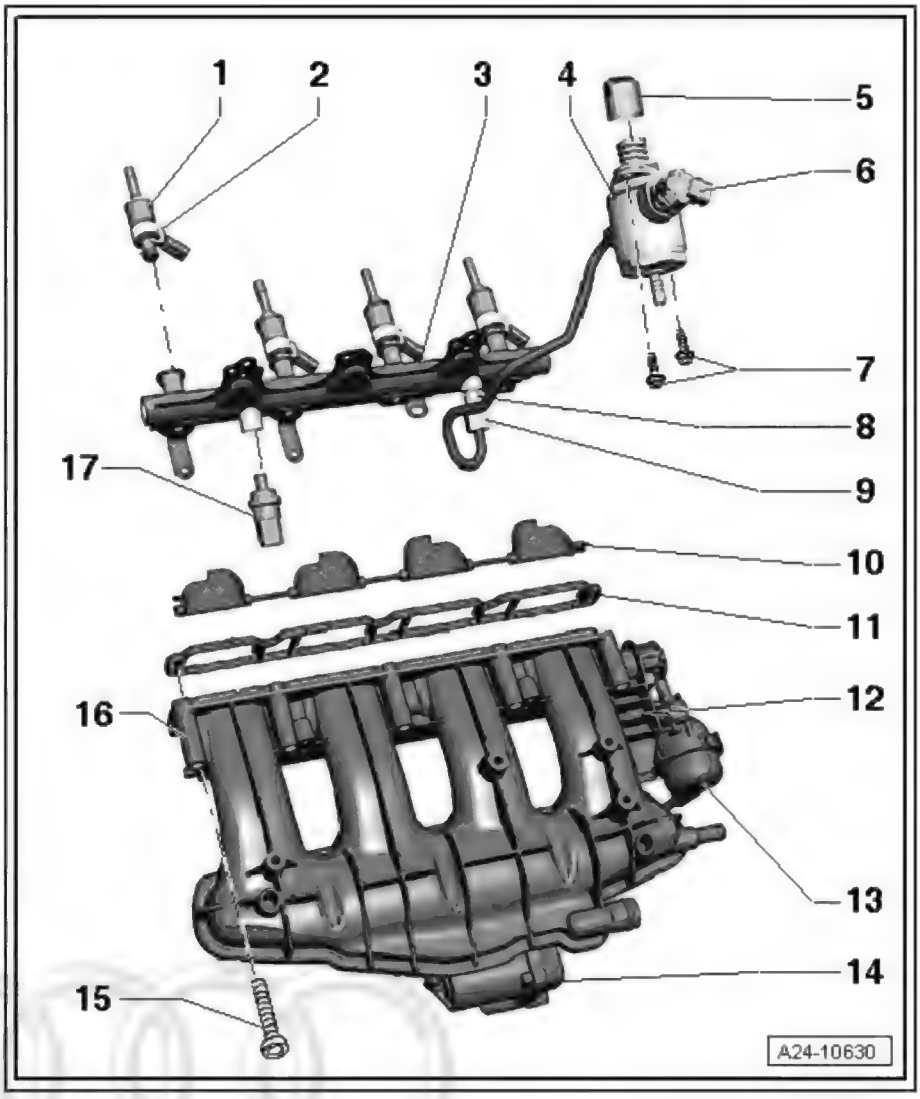
2 - Support ring

3 - Fuel rail

- ❑ Removing and installing ⇒ page 50

4 - High-pressure pump

- ❑ With fuel pressure regulating valve -N276-
- ❑ An electric fuel pump (fitted in fuel tank) supplies fuel to the mechanical high-pressure pump
- ❑ When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ❑ The fuel system must not be under pressure when installing the high-pressure pump; procedure for reducing fuel pressure ⇒ page 8
- ❑ Fuel lines must be free of tension when instal-



led.

- ❑ Removing and installing ⇒ page 63

5 - Roller tappet

6 - Fuel pressure regulating valve -N276-

7 - Bolts for high-pressure pump

- ❑ Hand-tighten in diagonal sequence, then tighten to 5 Nm and finally tighten to 20 Nm

8 - Connecting piece for fuel supply line at fuel rail

- ❑ Renew
- ❑ 40 Nm

9 - Union nut for fuel supply line

- ❑ 27 Nm

10 - Air flow control flaps (intake manifold flaps)

11 - Gasket

- ❑ Renew

12 - Intake manifold

- ❑ Removing and installing (CAEB, CDNB and CDZA) ⇒ page 38
- ❑ Removing and installing (vehicles with hybrid drive - CHJA) ⇒ page 42

13 - Vacuum unit for air flow control flaps (intake manifold flaps)

14 - Throttle valve module -J338- , throttle valve drive for electric throttle -G186-

- ❑ Throttle valve drive angle sender 1 for electric throttle -G187- and throttle valve drive angle sender 2 for electric throttle -G188-
- ❑ Throttle valve module -J338- must always be re-adapted to engine control unit -J623- after removal and installation or if it has been renewed. Use ⇒ Vehicle diagnostic tester in „Guided Functions“ mode.
- ❑ 7 Nm

15 - Bolts for intake manifold

- ❑ 9 Nm

16 - Intake manifold flap potentiometer -G336-

- ❑ After intake manifold flap potentiometer -G336- or intake manifold has been removed and installed or renewed, intake manifold flap potentiometer -G336- must be adapted to engine control unit -J623- . Use ⇒ Vehicle diagnostic tester in „Guided Functions“ mode.

17 - Fuel pressure sender -G247-

- ❑ 27 Nm
- ❑ Lubricate threads lightly with clean engine oil
- ❑ Always renew connecting piece and tighten to 25 Nm

4.5 Removing and installing fuel rail

After the fuel rail has been removed or renewed, intake manifold flap potentiometer -G336- must be adapted to engine control unit -J623- . Use ⇒ Vehicle diagnostic tester in „Guided Functions“ mode.

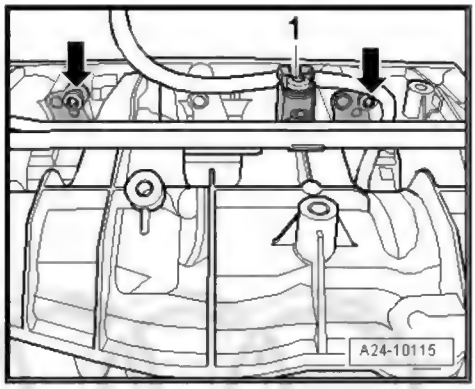
– Remove intake manifold ⇒ page 42 .

– Release hose clip -1-.

– Remove hoses from activated charcoal filter.

– Disconnect fuel line at fuel rail.

– Unscrew two bolts -arrows- on fuel rail.
– Detach fuel rail from intake manifold.



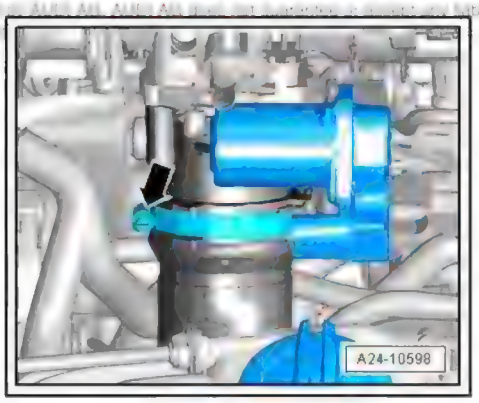
Installing

– Always renew both connecting pieces for fuel supply line.
– Connect and tighten fuel line.
– Re-connect electrical connectors.
– Install intake manifold ⇒ page 42 .
• Tightening torque: ⇒ „4.1 Exploded view - intake manifold", page 37
• Tightening torque: ⇒ „4.4 Exploded view - fuel rail", page 48
– Install in reverse order.

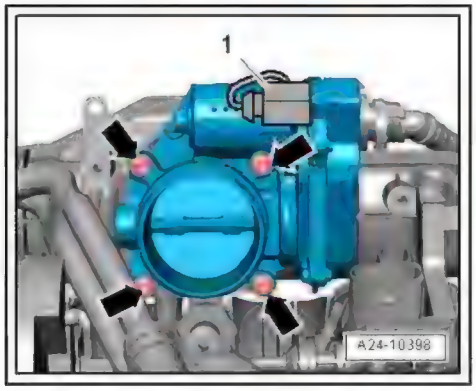
4.6 Removing and installing throttle valve module -J338- (vehicles without hybrid drive)

Removing

– Remove engine cover panel.
– Open hose clip -arrow- securing air intake hose and disconnect hose downwards from throttle valve module -J338- .
– Unplug electrical connector -1- from throttle valve module -J338- .



– Remove the four bolts -arrows- from throttle valve module -J338- and detach throttle valve module -J338- .



Installing

– Install in reverse order.
– Clean sealing surface for seal.
– Renew seal.
• Tightening torques: intake manifold - exploded view ⇒ page 37 .
– After throttle valve module -J338- has been renewed, it must be re-adapted to engine control unit -J623- using ⇒ Vehicle diagnostic tester.

4.7 Removing and installing throttle valve module -J338- (vehicles with hybrid drive - CHJA)

Safety precautions and repair instructions for vehicles with hybrid drive

DANGER!

Risk of fatal injury if high-voltage components are damaged.

Observe the following when working in the vicinity of high-voltage components or wiring:

- *It is not permitted to use cutting or forming tools, other sharp-edged tools or heat sources such as welding, brazing, soldering, hot air or thermal bonding equipment.*
- *Before starting work, visually inspect the high-voltage components in the areas involved.*
- *Before working in the engine compartment, visually inspect the power and control electronics for electric drive - JX1- , electric drive motor -V141- , air conditioner compressor -V470- and high-voltage wiring.*
- *Before working on the vehicle underbody, visually inspect the high-voltage wiring and covers.*
- *Before working on the rear section of the vehicle, visually inspect the high-voltage wiring and the electro-box with the maintenance connector for high-voltage system - TW - .*
- *Visually inspect all potential equalisation lines.*

Check the following when making the visual inspection:

- *There must be no external damage on any component.*
- *The insulation of the high-voltage wiring and potential equalisation lines must not be damaged.*
- *There must be no unusual deformation of the high-voltage wiring.*
- *All high-voltage components must be identified by a red warning sticker.*

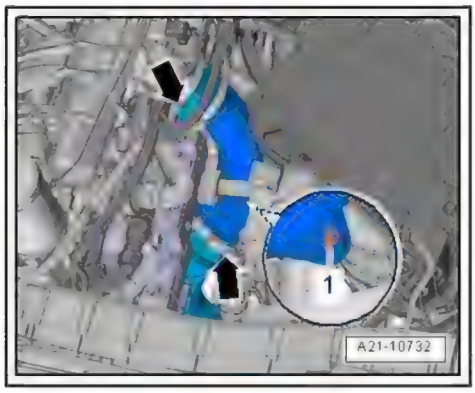
WARNING

Working on vehicles with high-voltage wiring:

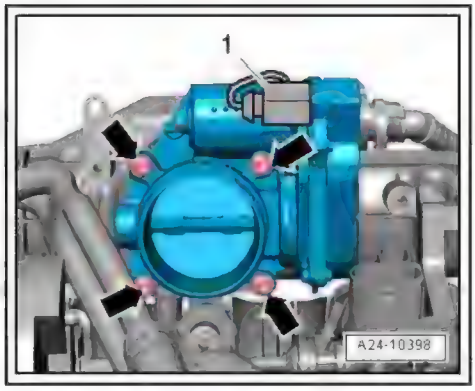
- *Do not support yourself or tools on high-voltage wiring or associated components --> this can damage the insulation.*
- *High-voltage wiring must not be excessively bent or kinked --> this can damage the insulation.*
- *The round high-voltage connectors are colour-coded with an external coloured ring and are provided with mechanical coding or guide lugs. It is important to observe this coding when joining up the round high-voltage connectors, otherwise the connectors can be damaged.*

Removing

– Remove engine cover panel.
– Detach coolant expansion tank and place to one side (coolant hose remains connected) ⇒ Engine, mechanics; Rep. gr. 19 .
– Loosen hose clips -arrows-.
– Unscrew bolt -1- and detach air pipe.



– Unplug electrical connector -1- from throttle valve module -J338- .
– Remove the four bolts -arrows- from throttle valve module -J338- and detach throttle valve module -J338- .



Installing

– Install in reverse order.
– Clean sealing surface for seal.
– Renew seal.
• Tightening torques
⇒ „4.1 Exploded view - intake manifold“, page 37
– After throttle valve module -J338- has been renewed, it must be re-adapted to engine control unit -J623- using ⇒ Vehicle diagnostic tester.

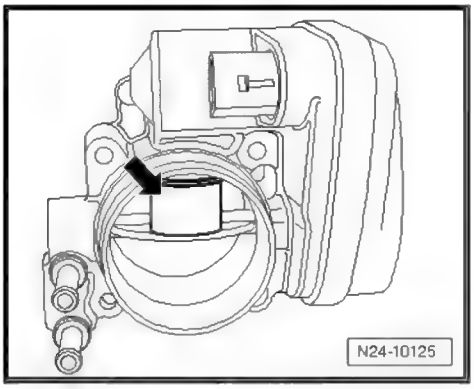
4.8 Cleaning throttle valve module -J338-

Note

♦ *The throttle valve module must be adapted if a new engine control unit -J623- is installed.*
♦ *Take care not to scratch the throttle valve housing when cleaning it.*

– Remove throttle valve module -J338-
⇒ „4.7 Removing and installing throttle valve module J338 (vehicles with hybrid drive - CHJA)“, page 52 .

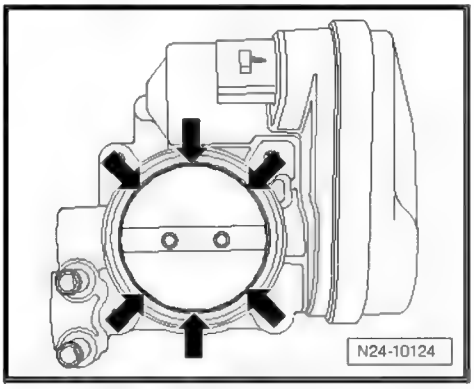
– Open throttle valve by hand and block it in the open position with a suitable object (e.g. plastic or wooden wedge) -arrow-.



WARNING

Acetone is highly flammable. Please observe all accident prevention regulations and safety precautions when handling flammable liquids. Do not use compressed air when cleaning the throttle valve. Wear safety goggles and protective clothing to avoid possible injury and skin contact.

– Clean throttle valve housing thoroughly, especially around the points -arrows- where the throttle valve closes, using commercially available acetone and a small brush.



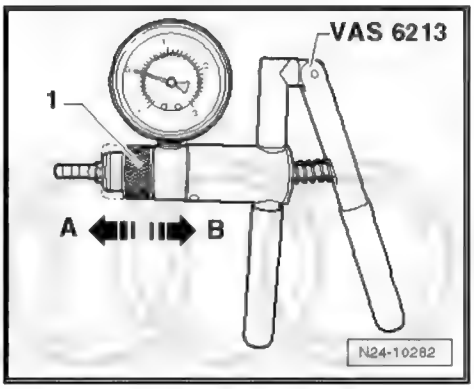
– Wipe out throttle valve housing with a lint-free cloth.
– Allow acetone to evaporate completely and re-install throttle valve module after cleaning.
– Erase learnt values and adapt engine control unit -J623- to throttle valve module using ⇒ Vehicle diagnostic tester.

4.9 Checking intake manifold change-over function

Only perform this test if there is a loss of engine torque (poor flexibility or lack of pulling power).

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



Test condition:

- Intake manifold flap valve -N316- has been checked with ⇒ Vehicle diagnostic tester.

Perform the following steps if the intake manifold flap valve -N316- is OK.

– Carefully pull off engine cover panel.
– Start engine and run at idling speed.
– Have a second mechanic rev up engine quickly (short burst of throttle) and observe vacuum unit for intake manifold change-over.

- The vacuum unit should pick up -arrow-.

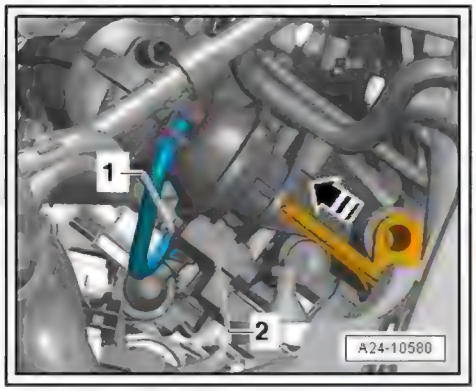
If the change-over does not operate as described:

– Check vacuum system for leaks.

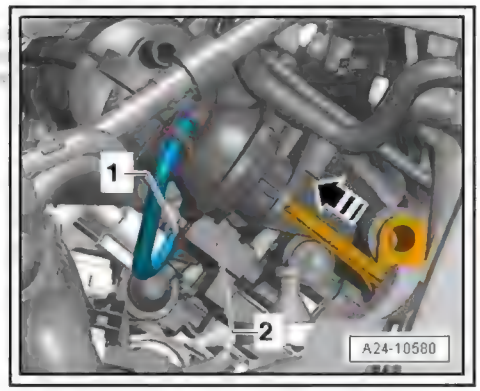
– Check that change-over mechanism moves freely by operating linkage manually.

– Check proper connection of vacuum lines.

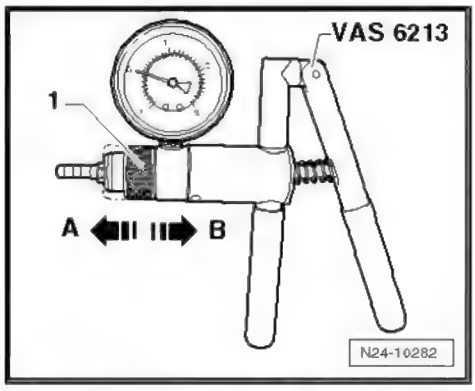
– Check vacuum hoses for porosity.



– Detach vacuum hose -1- from intake manifold flap valve -N316- -2-.



– Move adjuster ring -1- on hand vacuum pump -VAS 6213- to position -A- to select "vacuum".

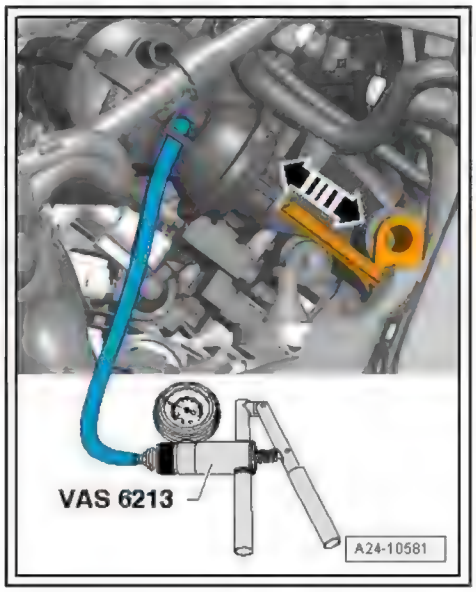


– Connect hand vacuum pump -VAS 6213- to vacuum unit for intake manifold flap valve -N316- .

– Operate the hand vacuum pump -VAS 6213- several times.

The vacuum unit should move -arrows-.

– If vacuum unit does not move, renew vacuum unit.



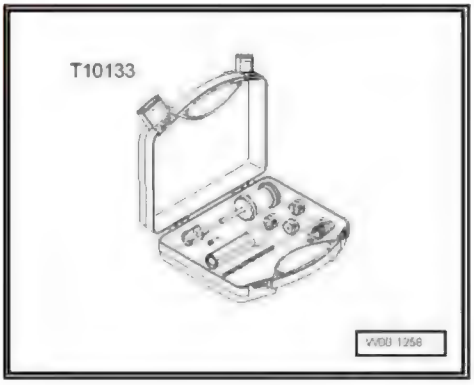
5 Injectors

Overview

5.1 Removing and installing injectors

Special tools and workshop equipment required

- Tool set for FSI engines -T10133-

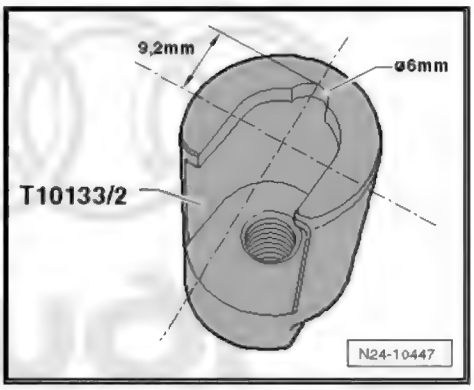


Note

Special tool T10133/2 (puller) has been modified and now has the designation puller T10133/2 A . If you have not yet received the new tool you can make the modification yourself.

Modifying special tool T10133/2 (puller) to make it equivalent to puller T10133/2 A

- File out a semi-circular recess as shown in the illustration. The recess allows the tool to be pushed further onto the injector so the contact surface is increased.
- For identification purposes, mark the modified tool with the letter „A“ after the tool number.



Special tools and workshop equipment required

- Round file, approx. 6 mm

Removing

- Remove engine cover panel ⇒ page 34 .
- Remove intake manifold and fuel rail ⇒ page 42 .

Removing injectors (from fuel rail)

Carefully pull injectors out of fuel rail.

Removing injectors (from cylinder head)

Injector

1 - Renew intermediate ring

2 - Retainer

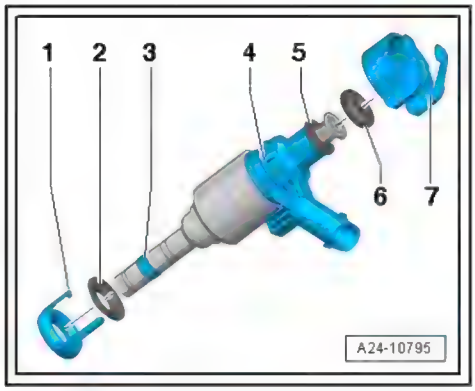
3 - Combustion chamber ring seal (teflon ring seal) - renew; when fitting, do not grease ring or use any other lubricant

4 - Injector

5 - Spacer ring (renew if damaged)

6 - O-ring (renew; apply thin coating of clean engine oil prior to installation)

7 - Renew support ring (via this support ring, fuel rail exerts force which secures injector in cylinder head)



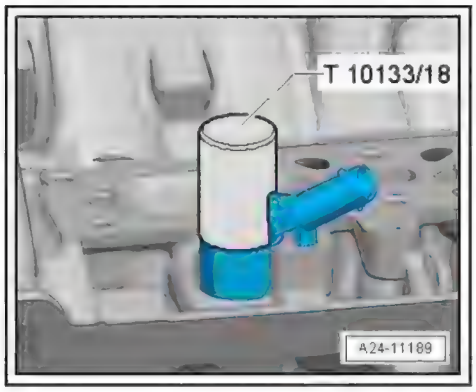
Note

Injectors must only be installed when the engine is cold.

– Cover open inlet ports with a clean cloth.

– Unplug electrical connector at injector that is to be removed.

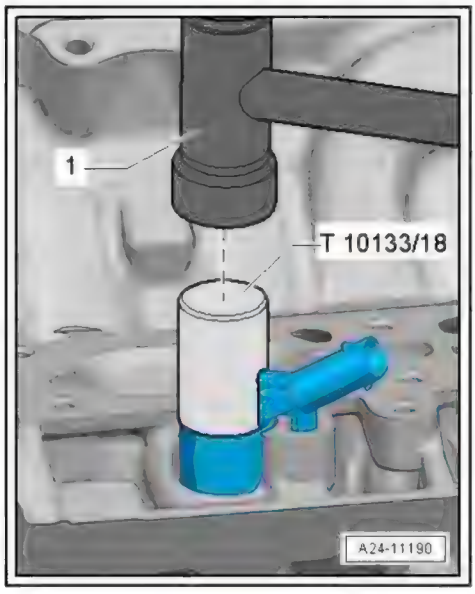
– Slide stop sleeve -T10133/18- over injector.



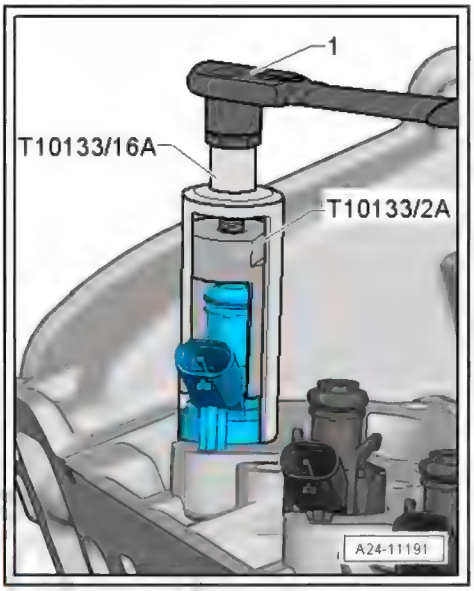
– Carefully knock against stop sleeve several times to loosen injector.

Note

- *Use a torque wrench to pull out injector.*
- *Adjust torque wrench to 5 Nm.*



– Guide puller -T10133/2A- into groove on injector.
– Then fit guide puller T10133/16A .
– Pull out injector by turning bolt with torque wrench -1-.
– If injector does not come loose after limit torque of 5 Nm is reached, remove puller and repeat procedure using stop sleeve to loosen injector.



Note

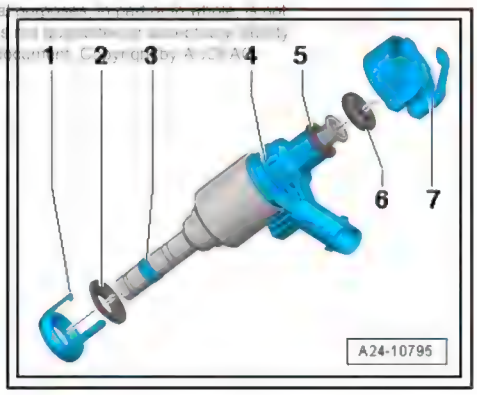
- *Observe correct torque to avoid irreparable damage to injector.*
- *The combustion chamber ring seal must always be renewed prior to reinstalling the injector*
⇒ „5.1.1 Renewing combustion chamber ring seal (teflon ring seal)", page 58 .

5.1.1 Renewing combustion chamber ring seal (teflon ring seal)

Note

The combustion chamber ring seal must always be renewed prior to reinstalling the injector.

– Carefully remove old combustion chamber ring seal -3- using suitable tools (e.g. cut open seal using a razor blade, or prise open seal with small screwdriver and then pull off forwards). It is important to ensure that the groove and the continuous ridge in the bottom of the groove are not damaged.

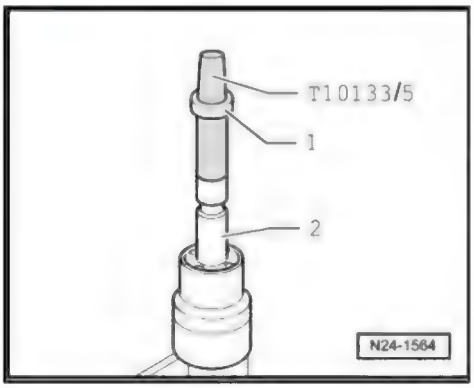


Note

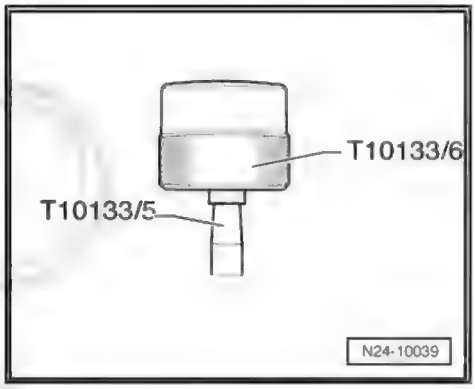
The injector must be renewed if the groove is damaged.

– Before new combustion chamber ring seal is fitted, any combustion residue must be removed from ring groove and injector stem using a clean cloth.

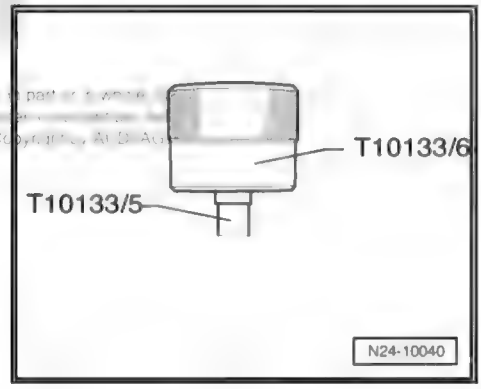
– Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



– Using assembly sleeve -T10133/6- , push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go.



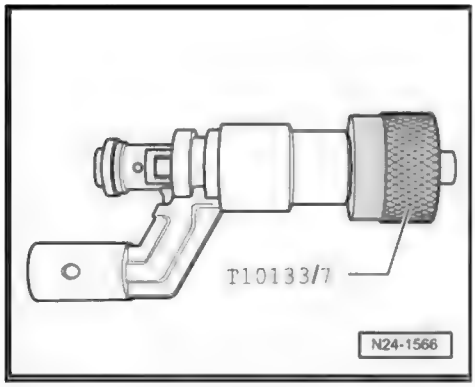
– Turn assembly sleeve -T10133/6- upside down and push combustion chamber ring seal to end of assembly cone -T10133/5- .
– Remove assembly cone -T10133/5- and push combustion chamber ring seal into sealing ring groove using assembly sleeve -T10133/6- .



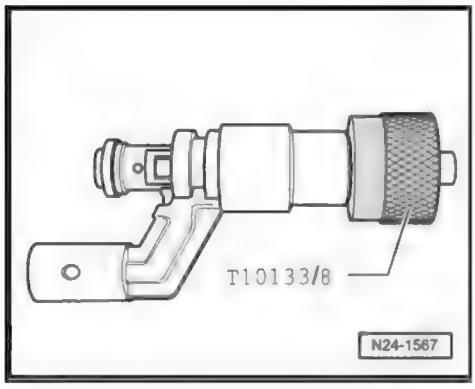
Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

– Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



– Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.
– Fit new O-ring on injector. Lubricate O-ring lightly with clean engine oil before installing.

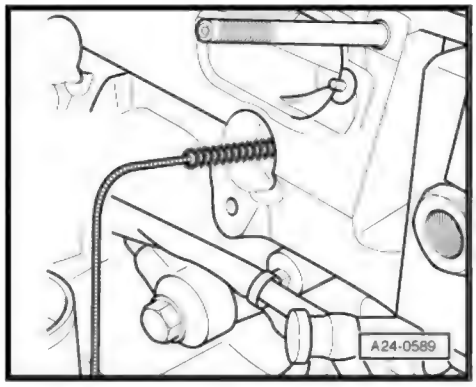


Note

- *The combustion chamber ring seal on the injector must not be oiled or greased.*
- *Make sure there is no cleaning fluid or oil in the cylinder head bores when installing the injectors.*

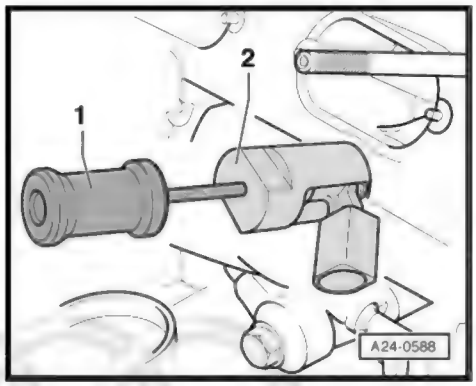
– Before installing injectors, thoroughly clean apertures for injectors in cylinder head using supplied nylon brush - T10133/4- .

– Push injector by hand as far as it will go into aperture in cylinder head (do not use oil or grease). Ensure that the injector is properly seated in the cylinder head.



Note

- *It should be possible to insert injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.*
- *Note correct installation position and ensure that injectors are properly seated in cylinder head.*
- *If the injector cannot be pushed in by hand, use puller - T10133/2A- -2- with striker -T10133/3- to insert the injector.*



– The remaining installation steps are carried out in the reverse sequence.

Important: the following points must always be observed:

- Coat O-rings of injector with clean engine oil to facilitate insertion into fuel rail.
- Renew all seals.
- Fuel rail must be positioned on injectors and pressed in evenly.
- Install intake manifold with fuel rail ⇒ page 42 .

5.2 Cleaning injectors

Special tools and workshop equipment required

- Ultrasonic cleaning unit -VAS 6418-
- Mounting plate for injection modules -VAS 6418/1-
- For cleaning fluid refer to electronic parts catalogue.

Cleaning

– Remove injectors ⇒ page 56 .

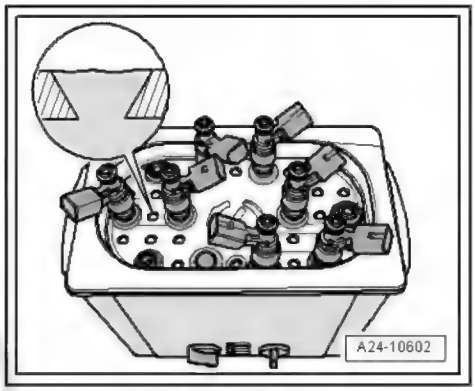
Note

Observe safety precautions and operating instructions for ultrasonic unit.

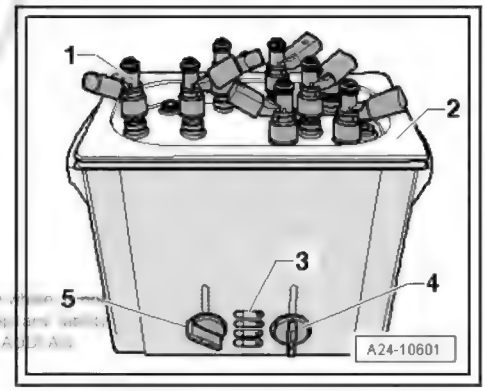
– Ultrasonic unit must be filled with cleaning fluid.

Note

Ultrasonic unit must be filled with cleaning fluid up to top edge of apertures (see detail in illustration).



- Insert injectors -1- all the way into mounting plate for injection modules -VAS 6418/1- -2-.
- Set rotary knob -4- to a temperature of 50°C.
- Select a cleaning time of 30 minutes with rotary knob -5-.
- Switch on ultrasonic unit with button -3-.



Note

The time set starts to elapse as soon as a cleaning temperature of 50°C has been reached.

- After cleaning, renew combustion chamber ring seal (teflon ring seal) for each injector ⇒ page 58 .
- Then re-install injectors ⇒ page 56 .

6 High-pressure pump

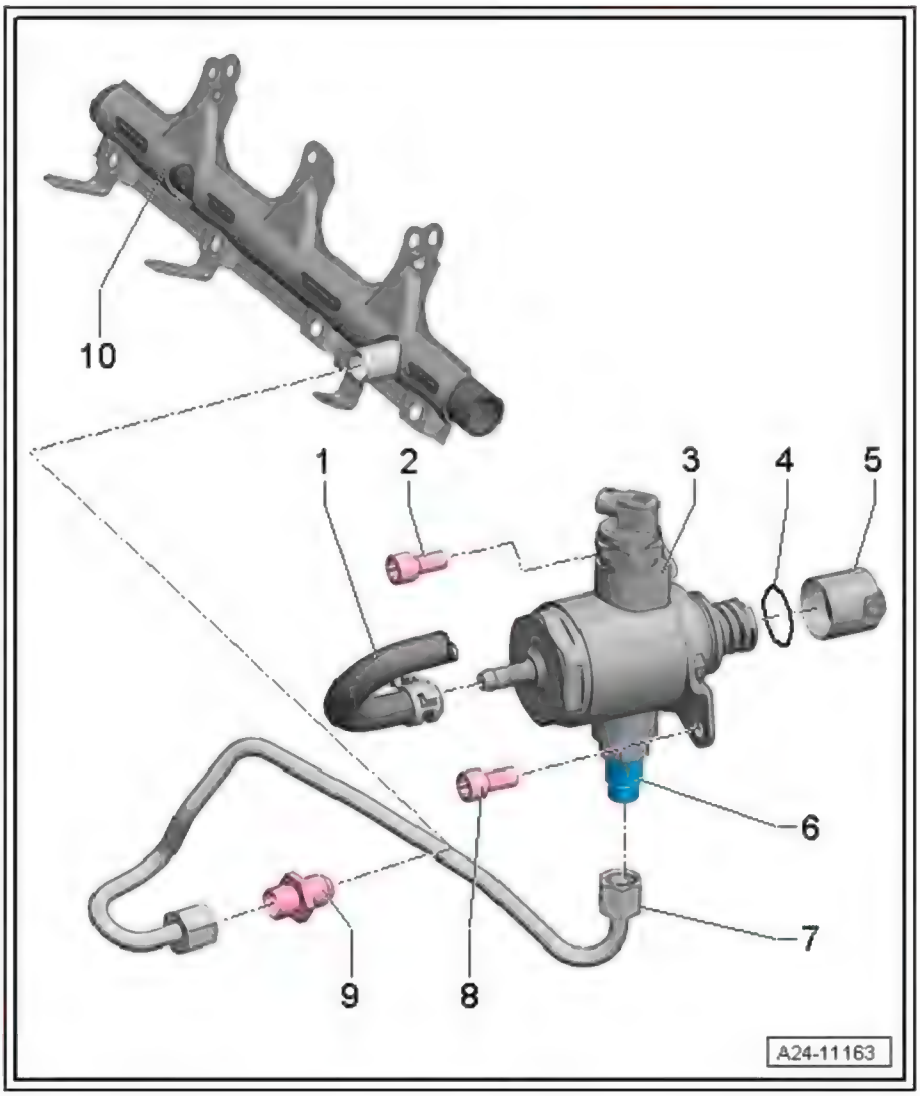
Overview

- ⇒ „6.1 Exploded view - high-pressure pump“, page 62
- ⇒ „6.2 Removing and installing high-pressure pump“, page 63

6.1 Exploded view - high-pressure pump

WARNING

Fuel system operates under high pressure. Always dissipate fuel pressure prior to opening fuel system. For procedure, refer to ⇒ page 8



1 - Fuel supply line from tank

2 - Bolts for high-pressure pump
- ❑ Hand-tighten in diagonal sequence, then tighten to 5 Nm and finally tighten to 20 Nm

3 - High-pressure pump
- ❑ An electric fuel pump (fitted in fuel tank) supplies fuel to the mechanical high-pressure pump
- ❑ When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.
- ❑ The fuel system must not be under pressure when installing the high-pressure pump; procedure for reducing fuel pressure ⇒ page 8
- ❑ Fuel lines must be free of tension when installed.
- ❑ Removing and installing ⇒ page 63

4 - O-ring
- ❑ Renew

5 - Roller tappet
- ❑ May remain lodged in vacuum pump when high-pressure pump is

removed

6 - Connecting piece
- ❑ Not available as replacement part, part of high-pressure pump
- ❑ Do not loosen

7 - High-pressure fuel pipe
- ❑ Fuel line must be free of tension when installed.
- ❑ 20 Nm

8 - Bolt for high-pressure pump
- ❑ Hand-tighten in diagonal sequence, then tighten to 5 Nm and finally tighten to 20 Nm
- ❑ Do not tilt high-pressure pump

9 - Connecting piece for fuel supply line at fuel rail
- ❑ Renew
- ❑ 40 Nm

10 - Fuel rail
- ❑ Removing and installing ⇒ page 50

6.2 Removing and installing high-pressure pump

WARNING

Fuel system operates under high pressure. Always dissipate fuel pressure prior to opening fuel system. For procedure, refer to ⇒ page 8

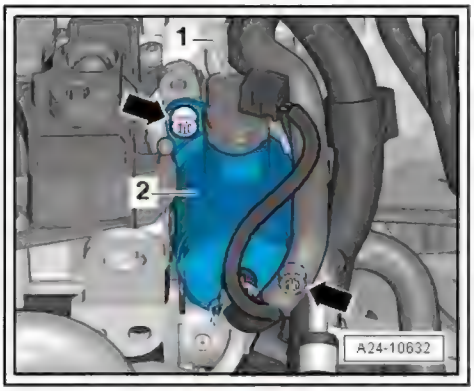
Note

- *The high-pressure fuel pump should only be removed and installed when the engine is cold.*
- *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- *Use a cloth to catch escaping fuel.*
- *The O-ring must always be renewed.*
- *Always ensure that the high-pressure fuel pipes are free of tension when tightening the connections.*

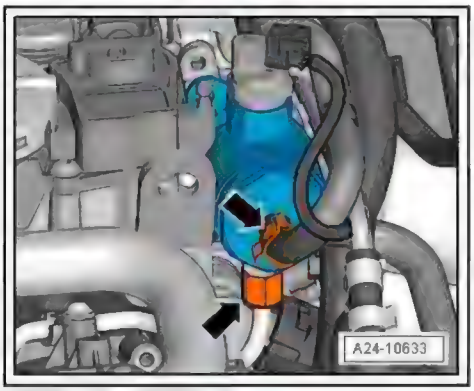
Removing

– Remove engine cover panel.

– Detach electrical connector -1- from fuel pressure regulating valve -N276- .

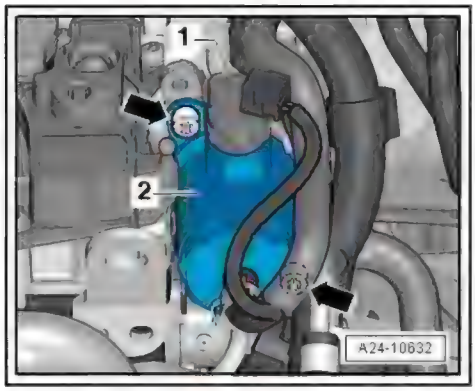


– Disconnect both fuel lines -arrows-.



– Remove 2 bolts -arrows-.

– Carefully pull out high-pressure pump. It is possible that the roller tappet may remain lodged in the vacuum pump.



Installing

– Renew O-ring for high-pressure pump.

– Fit roller tappet in vacuum pump (check roller tappet for damage first).

Note

♦ *The roller tappet must be positioned at the lowest point when installing the high-pressure pump.*

♦ *If the old high-pressure pump is re-installed, or if a used pump is installed, the connecting piece for the fuel supply line (high-pressure section of the system) must be renewed. Refer to high-pressure pump - exploded view (item 11)* ⇒ page 62 .

– Turn crankshaft until roller tappet is positioned at lowest point.

– Fit high-pressure pump in vacuum pump and secure in position.

– Tighten bolts hand-tight.

– Renew connecting piece at high-pressure pump.

• Tightening torque:
⇒ „6.1 Exploded view - high-pressure pump“, page 62

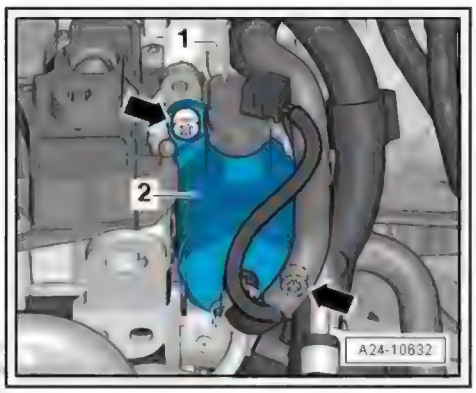
– Now tighten bolts in diagonal sequence to specified torque; see ⇒ „6.1 Exploded view - high-pressure pump“, page 62 .

– Tighten union nut on fuel supply line hand-tight. Align so that parts are free of tension.

• Tightening torque for fuel supply line (union nut):
⇒ „4.1 Exploded view - intake manifold“, page 37

– Re-attach electrical connector -1- for fuel pressure regulating valve -N276- .

– Put back fuse if it has been removed.



Note

Check fuel system for leaks.

7 Senders and sensors

Overview

7.1 Removing and installing air mass meter -G70-

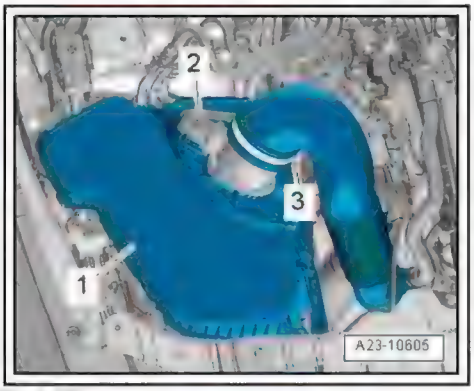
Removing

– Unplug electrical connector -2- at air mass meter -G70- .

– Open hose clip -3- at air hose and disconnect air hose at air mass meter -G70- .

– Unscrew both bolts from air mass meter -G70- .

– Then carefully pull air mass meter -G70- out of guide on air cleaner housing.



Installing

To ensure that the air mass meter -G70- functions properly, it is important to observe the following notes and instructions.

Note

- *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter -G70- and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- *Always use genuine part for air filter element.*
- *Use a silicone-free lubricant when installing the air hoses.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Check for salt residue, dirt and leaves in air mass meter and air intake hose (engine intake side).

– Check for dirt in air duct leading to air filter element. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ page 34 .

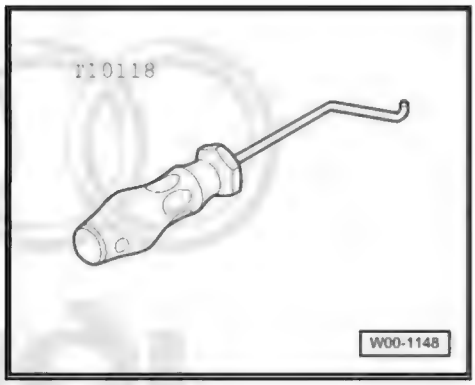
The remaining installation steps are carried out in the reverse sequence.

7.2 Removing and installing fuel pressure sender -G247-

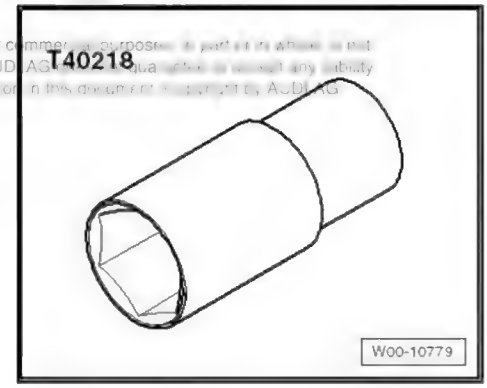
If the fuel pressure sender -G247- fails, the fuel pressure regulating valve -N276- is switched off, the electric fuel pump is fully activated and the engine is operated with the fuel pressure which remains. This will reduce engine torque considerably.

Special tools and workshop equipment required

- Assembly tool -T10118-



- Bit (27 mm) -T40218- or commercially available socket (27 mm)

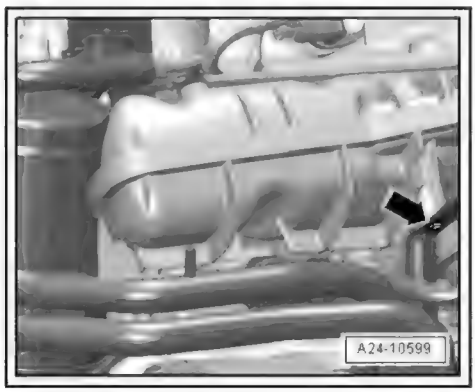


Removing

– Carefully pull off engine cover panel.

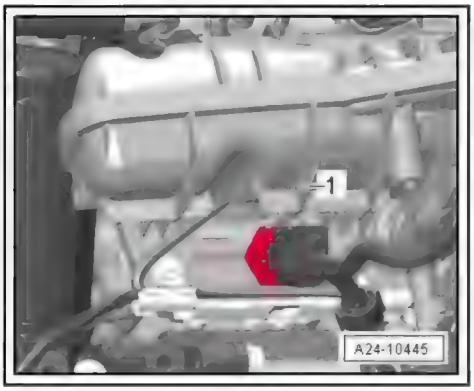
> **WARNING**
>
> *The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ page 8 .*

– Remove bolt -arrow- for coolant line from intake manifold.



– Release connector on fuel pressure sender -G247- using assembly tool -T10118- .

– Unscrew fuel pressure sender -G247- using bit, 27mm - T40218- .



Installing

– Install in reverse order.

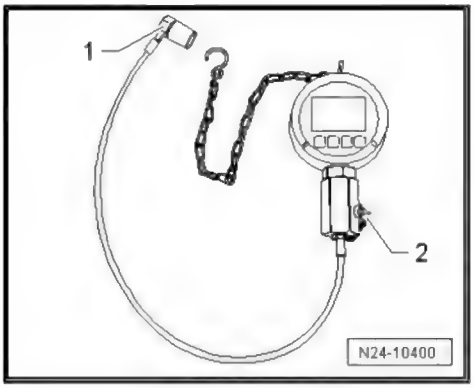
– Make sure that connecting piece is tightened to specified torque before installing fuel pressure sender -G247- .

- Tightening torque for connecting piece:
⇒ „4.4 Exploded view - fuel rail", page 48
- Tightening torque for Fuel pressure sender -G247- :
⇒ „4.4 Exploded view - fuel rail", page 48

7.3 Checking fuel pressure sender -G247-

Special tools and workshop equipment required

♦ Pressure sensor tester -VAS 6394-



♦ Adapter -VAS 6394/2-

♦ Test instrument adapter -VAS 5570-

♦ Torque wrench -V.A.G 1331-

♦ ⇒ Vehicle diagnostic tester

Procedure

– Remove engine cover panel.

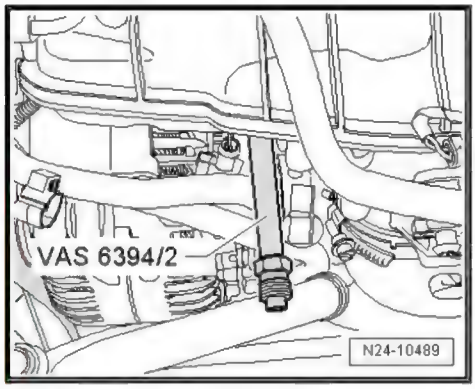
WARNING

The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ page 8 .

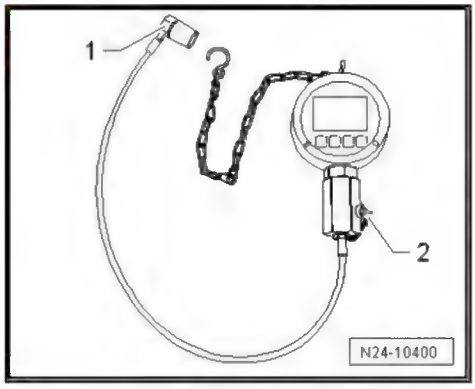
– Remove fuel pressure sender -G247- ⇒ page 66 .

– Screw in adapter -VAS 6394/2- in place of fuel pressure sender -G247- and tighten adapter with the same torque as that specified for fuel pressure sender -G247- .

- Tightening torque: ⇒ „4.4 Exploded view - fuel rail“, page 48

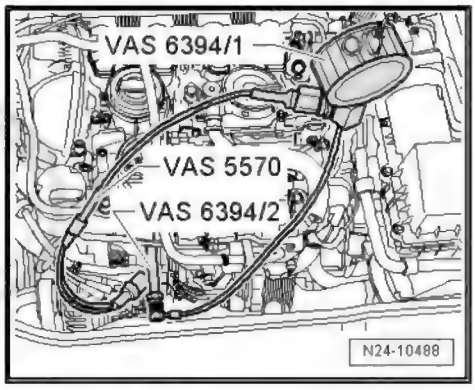


– Unscrew plug -2- on pressure sensor tester -VAS 6394/1- and screw in the removed fuel pressure sender -G247- . Tighten to torque normally specified for fuel pressure sender.



– Use test instrument adapter -VAS 5570- to make electrical connection between vehicle and fuel pressure sender -G247- .
– Connect a ⇒ Vehicle diagnostic tester.
– Switch on ignition.
– Select „Engine electronics“ in vehicle self-diagnosis.
– Then select „Measured values“.
– Select „Fuel pressure“ from the list.

The actual pressure value being transmitted to the engine control unit by the fuel pressure sender -G247- is displayed.

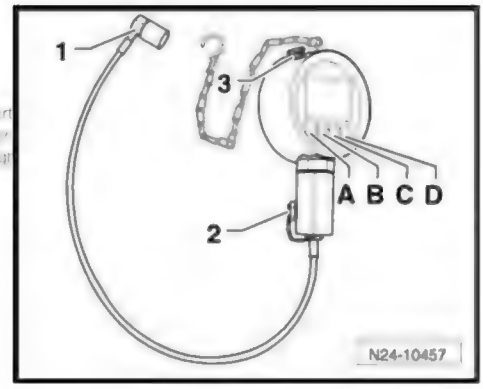


– Switch on pressure sensor tester -VAS 6394/1- by pressing button -A- once briefly.

Note

You can press and hold button -A- for 2 seconds to switch on the illumination for 20 seconds.

Pressure sensor tester -VAS 6394/1- should indicate 0 bar. If this is not the case, press button -C- once briefly to zero the tester.



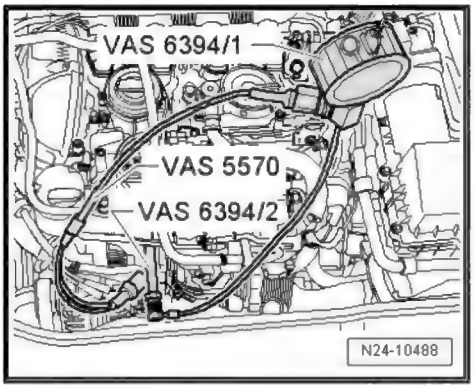
– Connect pressure line of pressure sensor tester -VAS 6394/1- to adapter -VAS 6394/2- .

– Start engine.

– Compare the pressure indicated by pressure sensor tester -VAS 6394/1- with the actual pressure value on the vehicle diagnostic tester .

• The pressure readings must not deviate by more than 5 bar.

– If the deviation is more than 5 bar, test a new fuel pressure sender -G247- .



WARNING

The fuel system is pressurised. The fuel pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening; for procedure see ⇒ page 8 .

– Screw a new fuel pressure sender -G247- into the pressure gauge -VAS 6394/1- .

– Repeat the test with the new fuel pressure sender -G247- and compare the two pressure values.

If the two values still do not agree:

– Check the electrical connection between the fuel pressure sender -G247- and the engine control unit; refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

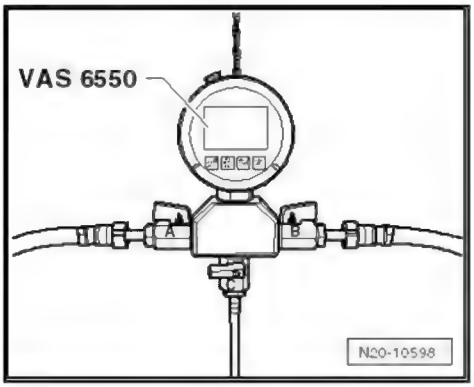
If the values agree:

– Install the new fuel pressure sender -G247- ⇒ page 66 .

7.4 Checking residual pressure in fuel system (up to high-pressure pump)

Special tools and workshop equipment required

♦ Pressure tester -VAS 6550-



♦ Fuel-resistant measuring container

♦ Protective gloves

♦ ⇒ Vehicle diagnostic tester

Test conditions:

• Battery voltage at least 12.5 V.

• Fuel filter OK.

• Fuel tank at least 1/4 full.

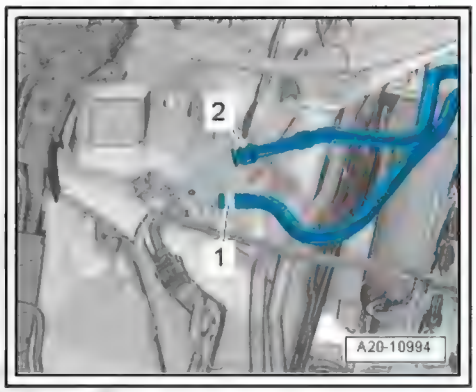
- Fuel pump control unit -J538- OK.
- Ignition off.

Checking fuel pressure

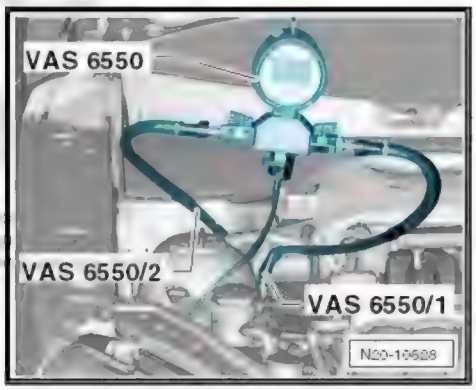
WARNING

- *The pressure in the high-pressure part of the injection system must be reduced to a residual pressure prior to opening the system ⇒ page 8 .*
- *A clean cloth must then be wrapped around the connection and the residual pressure dissipated by carefully loosening the connection.*

– Disconnect fuel line -2- by pulling release ring -1-.



– Connect pressure tester -VAS 6550- .
– Connect a ⇒ Vehicle diagnostic tester.
– Select „Engine electronics“ in vehicle self-diagnosis.
– Then select „Final control diagnosis“.
– Select „Fuel pump electronics“ from list and press „start“.



Note

This function activates the fuel pump.

– Read fuel pressure off pressure tester -VAS 6550- .
- Specification: 4 to 8 bar
– End this function when fuel pressure stops rising on pressure tester -VAS 6550- .

If specification is not obtained:

– Check delivery rate of fuel pump ⇒ Rep. gr. 20 .

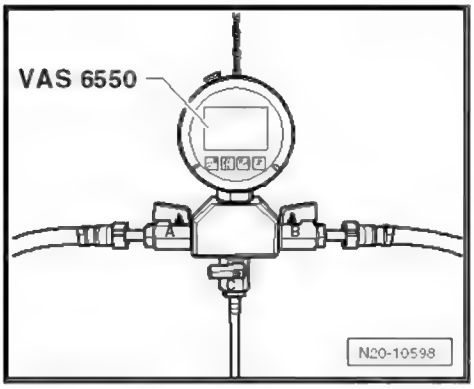
Checking residual pressure

– Check system for leaks and check residual pressure by watching the drop in pressure on the pressure tester -VAS 6550- .
- After 10 minutes pressure should still be at least 3 bar.

If the residual pressure drops below 3 bar:

– Use final control diagnosis to activate fuel pumps again; this will allow fuel pressure to build up.

– Close cut-off valve -B- on pressure tester immediately once pressure has built up. Lever then points perpendicular to throughflow direction.



If pressure now no longer drops:

– Look for leaks on engine side.

– Repeat residual pressure test. Close the cut-off valve -A- this time to find out if there really is a leak on the engine side.

If the pressure drops again:

Look for leaks on fuel tank side.

- ♦ Check pressure tester for leaks.
- ♦ Check fuel lines and their connections for leaks.
- ♦ Check delivery rate of fuel pump ⇒ Rep. gr. 20 .
- ♦ Renew fuel filter with integrated fuel pressure regulator ⇒ Rep. gr. 20 .
- ♦ Non-return valve of fuel pump is defective ⇒ Rep. gr. 20 .

Assembly is carried out in the reverse order; note the following:

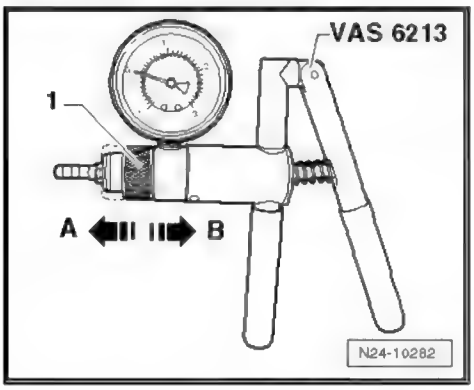
Note

Check fuel system for leaks.

7.5 Checking dual non-return valve

Special tools and workshop equipment required

- ♦ Hand vacuum pump -VAS 6213-



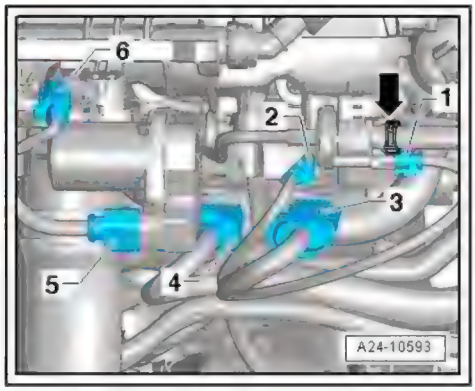
- ♦ Auxiliary measuring set -V.A.G 1594C-

Test condition:

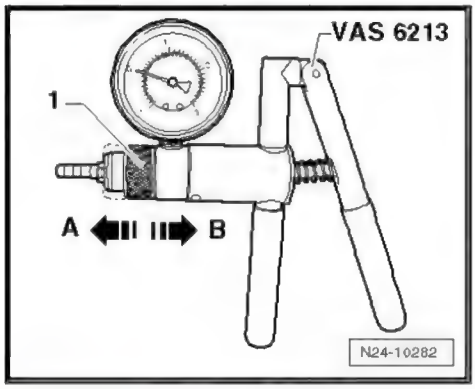
- Activated charcoal filter solenoid valve 1 -N80- has been checked with ⇒ Vehicle diagnostic tester and is OK.

– Carefully pull off engine cover panel.

– Unplug connector -1- and detach breather hose -arrow- from activated charcoal filter solenoid valve 1 -N80- .



– Move adjuster ring -1- on hand vacuum pump -VAS 6213- to position -A- to select "vacuum".



– Connect hand vacuum pump -VAS 6213- to activated charcoal filter solenoid valve 1 -N80- .
– Connect contacts of activated charcoal filter solenoid valve 1 -N80- -1- to battery using test leads. This will open activated charcoal filter solenoid valve 1 -N80- .

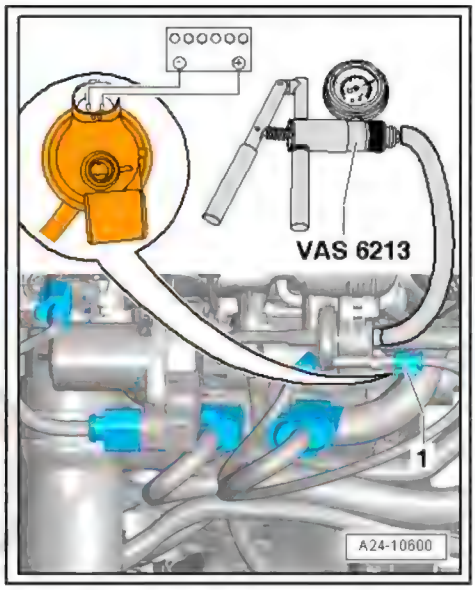
Then immediately operate hand vacuum pump -VAS 6213- several times.

- Vacuum should build up.

– Again disconnect battery to cut off current supply.

If vacuum does not build up:

– Renew dual non-return valve.



Note

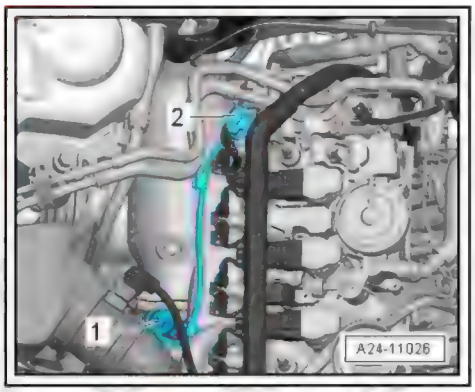
Dual non-return valve, activated charcoal filter solenoid valve 1 -N80- and plastic hoses are combined as one unit and can only be renewed together.

8 Lambda probe

Overview

- ⇒ „8.1 Exploded view - Lambda probe“, page 74
- ⇒ „8.2 Removing and installing Lambda probe G39 and Lambda probe heater Z19 before catalytic converter“, page 75
- ⇒ „8.3 Removing and installing Lambda probe after catalytic converter G130 and Lambda probe 1 heater after catalytic converter Z29 “, page 75

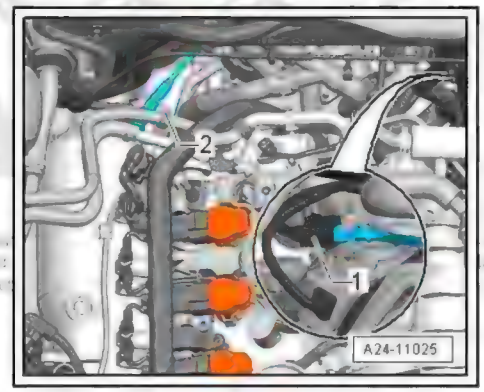
8.1 Exploded view - Lambda probe



Lambda probe

1 - Lambda probe -G39- and Lambda probe heater -Z19-

2 - Electrical connector for Lambda probe -G39-



Lambda probe

1 - Electrical connector for Lambda probe after catalytic converter -G130-

2 - Lambda probe after catalytic converter -G130- and Lambda probe heater 1 after catalytic converter -Z29-

- Tightening torque: 55 Nm

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Parts catalogue*
- *When installing, the Lambda probe wiring must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

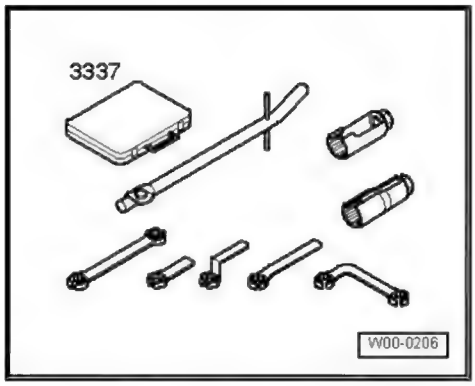
Removing and installing Lambda probe -G39- and Lambda probe heater -Z19-
⇒ „8.2 Removing and installing Lambda probe G39 and Lambda probe heater Z19 before catalytic converter“, page 75 .

Removing and installing Lambda probe after catalytic converter -G130- and Lambda probe 1 heater after catalytic converter -Z29-
⇒ „8.3 Removing and installing Lambda probe after catalytic converter G130 and Lambda probe 1 heater after catalytic converter Z29 “, page 75

8.2 Removing and installing Lambda probe -G39- and Lambda probe heater -Z19- before catalytic converter

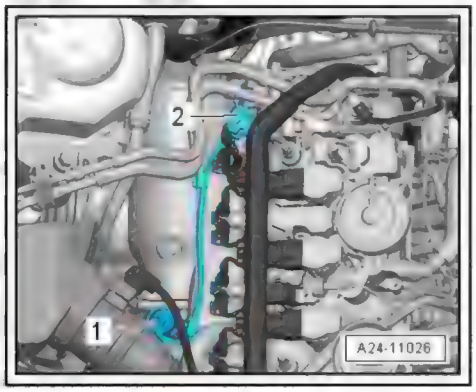
Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



Removing

- Unplug electrical connector -2- for Lambda probe -G39- and Lambda probe heater -Z19- .
- Unscrew Lambda probe -G39- -1- using tool from Lambda probe open ring spanner set -3337- .



Installing

When installing, note the following:

Note

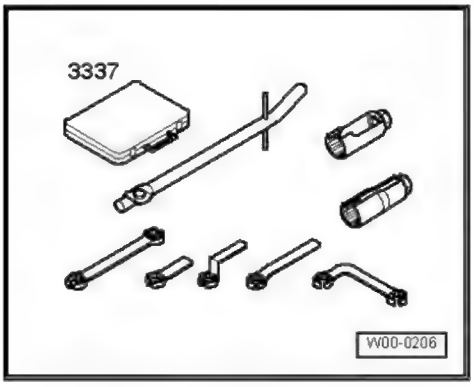
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Parts catalogue*
- *When installing, the Lambda probe wiring must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

- Tightening torque:
⇒ „8.1 Exploded view - Lambda probe“, page 74

8.3 Removing and installing Lambda probe after catalytic converter -G130- and Lambda probe 1 heater after catalytic converter -Z29-

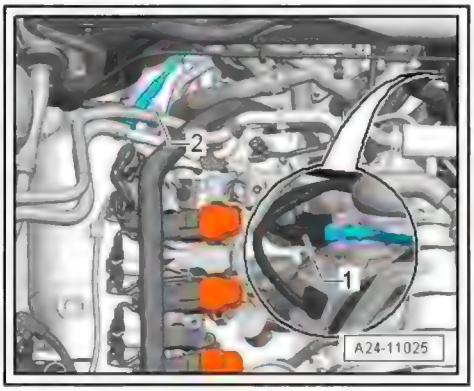
Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



Removing

– Unplug electrical connector -1- for Lambda probe after catalytic converter -G130- and Lambda probe 1 heater after catalytic converter -Z29- .
– Unscrew Lambda probe after catalytic converter -G130- -2- using tool from Lambda probe open ring spanner set -3337- .



Installing

When installing, note the following:

Note

- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Parts catalogue*
- *When installing, the Lambda probe wiring must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

- Tightening torque:
⇒ „8.1 Exploded view - Lambda probe“, page 74

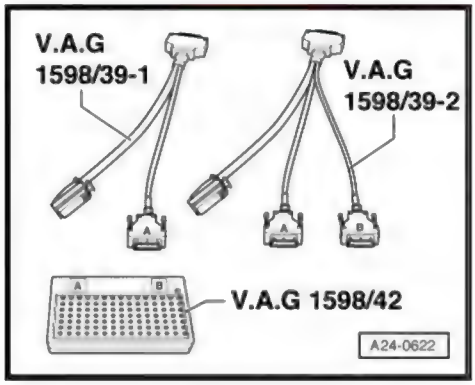
9 Engine control unit

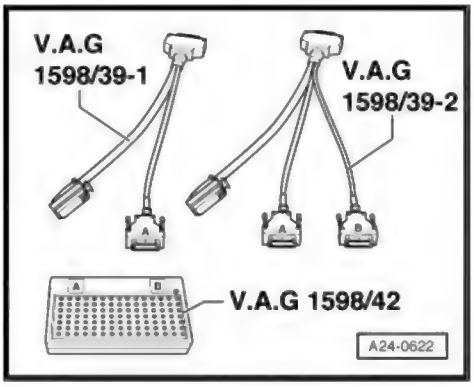
Overview

9.1 Wiring and component check with test box -V.A.G 1598/42- (engine codes CAEB, CDNB, CDZA)

Special tools and workshop equipment required

- Adapter cable -V.A.G 1598/39-1-
- Adapter cable -V.A.G 1598/39-2-
- Test box -V.A.G 1598/42-





Note

- *The test box has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.*
- *The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.*
- *To carry out tests on the 60-pin wiring harness connector, the adapter cable -V.A.G 1598/39-1- is connected to connector „A" on the test box. For components connected to 60-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *To carry out tests on the 94-pin wiring harness connector, the adapter cable -V.A.G 1598/39-2- must be connected to connectors „A" and „B" on the test box. For components connected to 94-pin wiring harness connector ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *The test box -V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- *The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.*

WARNING

To prevent irreparable damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

- Remove engine control unit ⇒ page 80 .
- Connect test box -V.A.G 1598/42- to wiring harness with adapter cable -V.A.G 1598/39-1- or adapter cable -V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.
- Install engine control unit ⇒ page 80 .
- Interrogate event memory and erase if necessary. Use ⇒ Vehicle diagnostic tester.

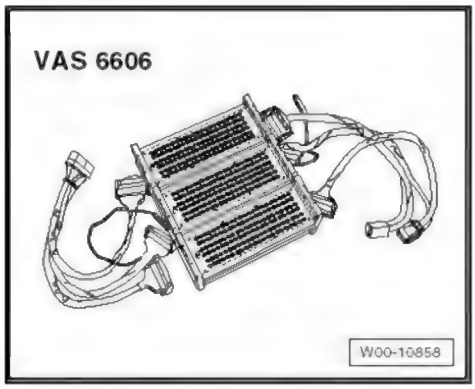
Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified until all fault entries can be erased.

9.2 Wiring and component check with isolator box, 198-pin -VAS 6606- for vehicles with hybrid drive (engine code CHJA)

Special tools and workshop equipment required

- Isolator box, 198-pin -VAS 6606/1-1-
- Isolator box, 198-pin -VAS 6606/1-2-
- Isolator box, 198-pin -VAS 6606/1-3-
- Sheets -VAS 6606/1-1-
- Sheets -VAS 6606/2-1-
- Sheets -VAS 6606/3-1-
- Set of cables -VAS 6606/7-1- and -VAS 6606/7-2-



Note

- *Always make sure that the cables are properly connected.*
- *Do not use damaged or worn tools and accessories.*
- *Observe operating instructions.*

– Connect both cable sets -VAS 6606/7-1- and -VAS 6606/7-2- to the three isolator boxes -VAS 6606- .

– Use the following sheets:

- -VAS 6606/1-1- for isolator box, 198-pin -VAS 6606/1-1-
- -VAS 6606/2-1- for isolator box, 198-pin -VAS 6606/1-2-
- -VAS 6606/3-1- for isolator box, 198-pin -VAS 6606/1-3-

Note

Make sure that all plug-in bridges are inserted completely in all isolator boxes.

– Connect earth strap to an isolator box and to an earth point on the vehicle.

– Remove engine control unit ⇒ page 80 .

– Connect engine control unit to cable set -VAS 6606/7-1- .

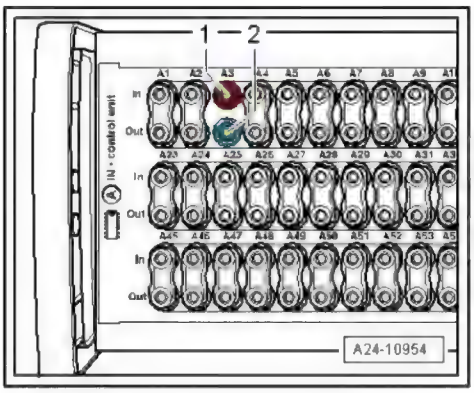
– Connect vehicle wiring harness to cable set -VAS 6606/7-2-

The connection on the engine control unit consists of a large and a small connector.

The large connector has 105 pins and is assigned to the sheets for the isolator box marked „A 1 to A 105".

The small connector has 91 pins and is assigned to the sheets for the isolator box marked „B 1 to B 91".

When a push-in bridge is pulled out, the corresponding wiring connection is disconnected.



Note

- *The „In" contact -1- (red socket) leads to the engine control unit.*
- *The „Out" contact -2- (blue socket) leads to the wiring harness.*

– Carry out test as described in appropriate repair procedures.

Installing engine control unit

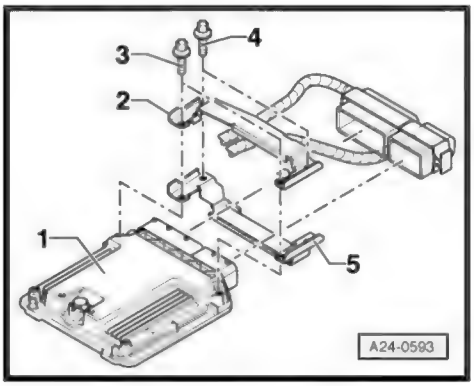
Installation is performed in the reverse sequence.

– Interrogate event memory and erase if necessary. Use ⇒ Vehicle diagnostic tester.

Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining faults registered in the memories must be rectified until all fault entries can be erased.

9.3 Removing and installing engine control unit -J623-



Note

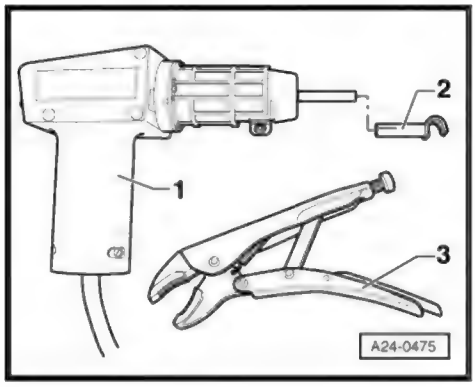
- *Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/ gearbox combination.*
- *The engine control unit -1- is bolted to a protective casing -2 and 5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.*
- *The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).*

The following special tools are required if a protective housing is fitted:

Special tools and workshop equipment required

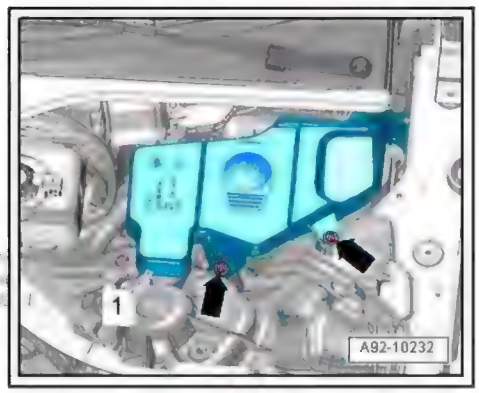
- Hot air blower -VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set -VAS 1978 B-

♦ Small, commercially available mole grips -3-

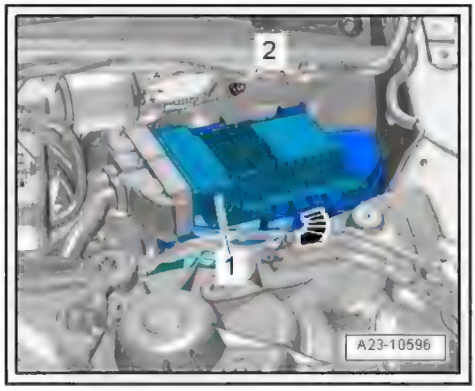


Removing

– When renewing engine control unit, select diagnosis object „Replace engine control unit“ in „Guided Functions“ mode of ⇒ Vehicle diagnostic tester.
– Switch off ignition and remove ignition key.
– Remove plenum chamber cover ⇒ Rep. gr. 50 .
– Unscrew bolts -arrows- and pull filler neck out of washer fluid reservoir and through opening in body to right side.



– Release catch -arrow- and detach engine control unit -J623- -item 1-.



Note

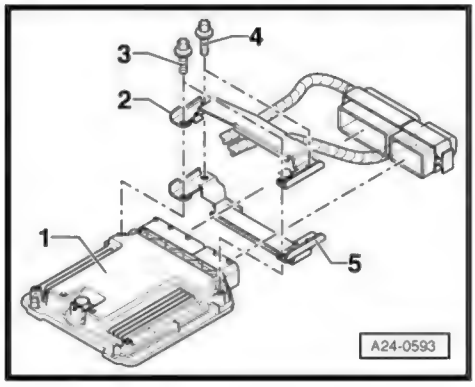
Disregard -item 2-.

Perform the following work steps if a protective housing is fitted:

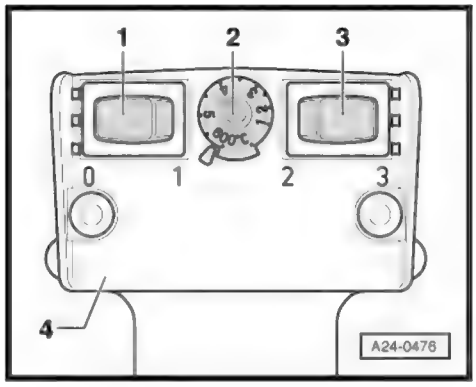
To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted to a protective housing -5- by means of shear bolts -3 and 4- and a locking plate -2-.

The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



– Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.

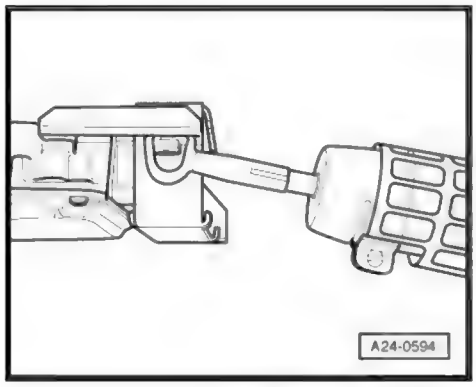


WARNING

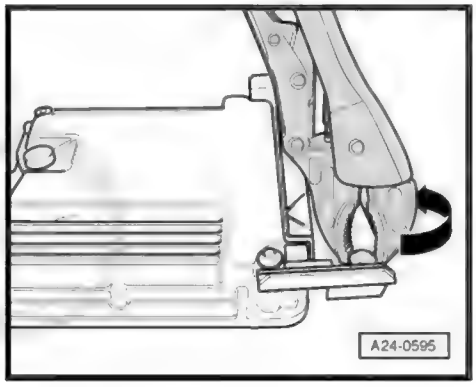
Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

Apply heat to the threads of the shear bolts on the connector side as shown in the illustration.

– Apply heat to the threads of the shear bolts on the connector side for approx. 25 to 30 seconds.
– Unscrew shear bolts using suitable vice-grip pliers (see arrow in illustration).



– The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
– Detach protective housing from control unit connectors.
– Release connectors on engine control unit and unplug connectors.
– Take out old engine control unit -J623- and install new engine control unit -J623- .



Installing

Installation is performed in the reverse sequence.

– It is important that the protective housing is re-fitted on the engine control unit -J623- (if fitted previously).
– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
– Always use new shear bolts.

After installing a new engine control unit, the following operation must be performed:

– Activate engine control unit using ⇒ Vehicle diagnostic tester in „Guided Functions“ mode, „Replace engine control unit“.

28 – Ignition system

1 General notes and safety precautions

Overview

- ⇒ „1.1 General notes on ignition system“, page 83
- ⇒ „1.2 Safety precautions“, page 83

1.1 General notes on ignition system

- The engine control unit has a self-diagnosis capability.
- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- Certain tests may lead to a fault being detected by the control unit and stored. The event memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobilizer disabling the engine control unit. The event memory must then be interrogated and, if necessary, the control unit must be adapted.

1.2 Safety precautions

Note the following if testers and measuring instruments have to be used during a road test:

WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- *Observe notes on procedure for disconnecting the battery.*

– Disconnect battery ⇒ Rep. gr. 27 .

To prevent injuries to persons and/or irreparable damage to the fuel injection and ignition system, the following must be noted:

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.

- The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- If you want to crank the engine at starting speed without actually starting it (e.g. compression test), first unplug the connectors from the ignition coils and the injectors.
- Always switch off the ignition before cleaning the engine.

2 Ignition system

Overview

2.1 Test data

Engine data	2.0 ltr. turbo FSI engine
Idling speed (cannot be adjusted; is regulated by idling speed stabilisation)	640...800 rpm
Engine speed limiter (deactivates injectors/closes throttle valve)	approx. 6,500 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Multi-coil ignition system with 4 ignition coils (integrated output stages) connected directly to spark plugs via spark plug connectors; ignition coils can be pulled out of cylinder head using puller - T40039 -
Firing order	1-3-4-2

2.2 Exploded view - ignition system

1 - Knock sensor 1 -G61-
- ❑ Contacts gold-plated
- ❑ Removing and installing ⇒ page 88

2 - Ignition coil with output stage
- ❑ Ignition coil 1 with output stage -N70-
- ❑ Ignition coil 2 with output stage -N127-
- ❑ Ignition coil 3 with output stage -N291-
- ❑ Ignition coil 4 with output stage -N292-
- ❑ Removing and installing ⇒ page 86
- ❑ Use puller -T40039- for removal

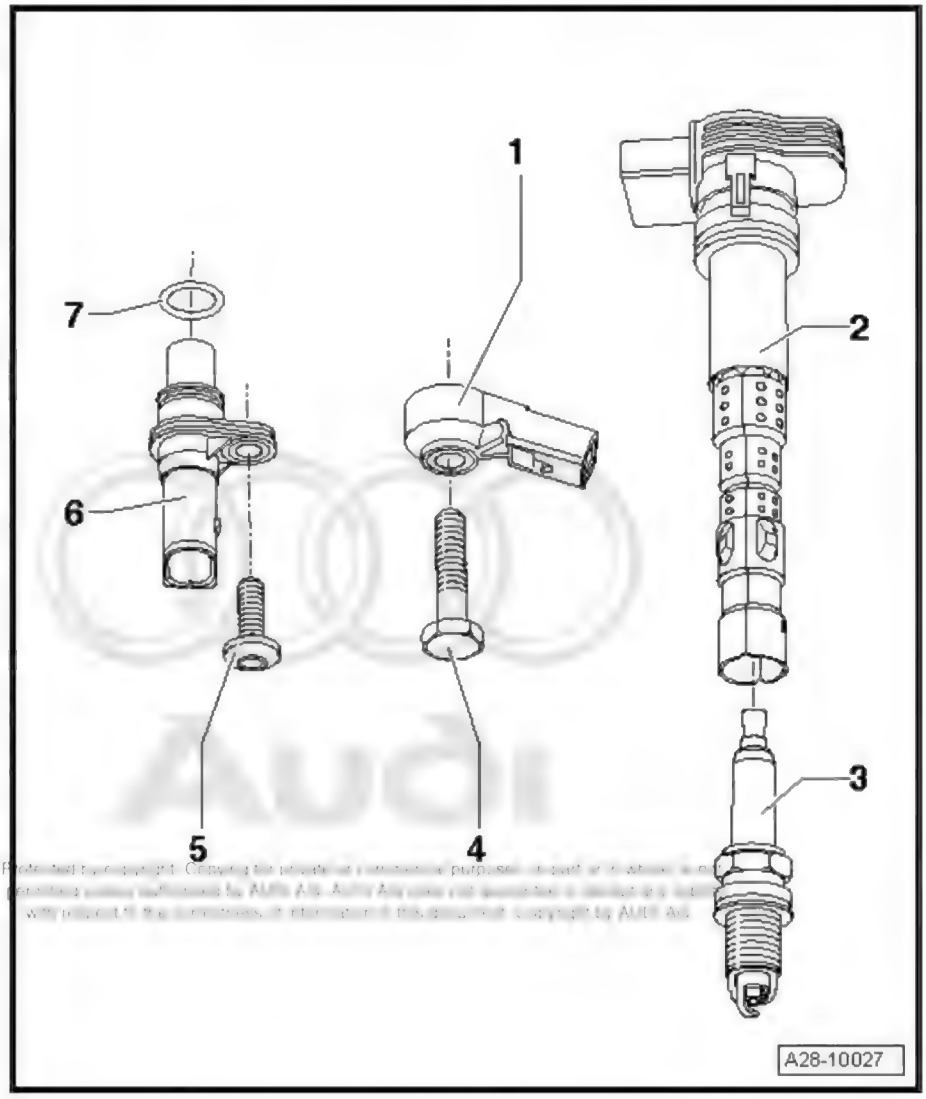
3 - Spark plug
- ❑ 30 Nm
- ❑ For removing and installing refer to ⇒ Maintenance ; Booklet 411

4 - Bolt
- ❑ 20 Nm
- ❑ Tightening torque influences functions of knock sensor

5 - Bolt
- ❑ 10 Nm

6 - Hall sender -G40-
- ❑ Contacts gold-plated

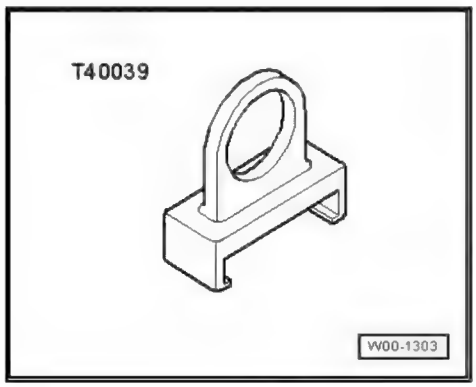
7 - O-ring
- ❑ Renew O-Ring if damaged



2.3 Removing and installing ignition coils with output stages

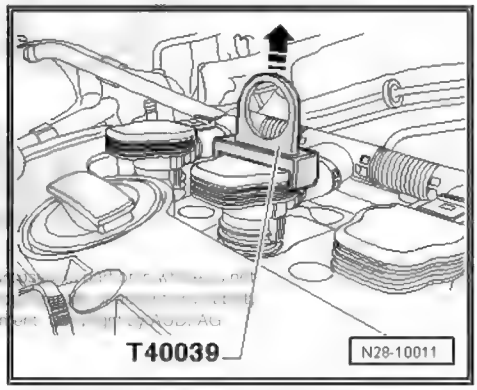
Special tools and workshop equipment required

- ♦ Puller -T40039-



Removing

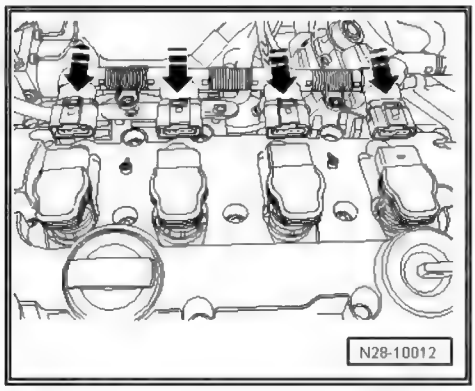
- Remove engine cover.
- Unscrew two bolts on connector rail.
- Pull all ignition coils approx. 30 mm out of spark plug holes using puller -T40039- .
- Release connectors and unplug all connectors from the ignition coils at the same time.



Installing

- Fit all ignition coils loosely into spark plug holes.

- Align the ignition coils with the connectors and attach all connectors onto ignition coils simultaneously.
- Press ignition coils onto spark plugs by hand with uniform pressure (do not use any tools).



2.4 Removing knock sensor 1 -G61-

Safety precautions and repair instructions for vehicles with hybrid drive

DANGER!

Risk of fatal injury if high-voltage components are damaged.

Observe the following when working in the vicinity of high-voltage components or wiring:

- *It is not permitted to use cutting or forming tools, other sharp-edged tools or heat sources such as welding, brazing, soldering, hot air or thermal bonding equipment.*
- *Before starting work, visually inspect the high-voltage components in the areas involved.*
- *Before working in the engine compartment, visually inspect the power and control electronics for electric drive - JX1- , electric drive motor -V141- , air conditioner compressor -V470- and high-voltage wiring.*
- *Before working on the vehicle underbody, visually inspect the high-voltage wiring and covers.*
- *Before working on the rear section of the vehicle, visually inspect the high-voltage wiring and the electro-box with the maintenance connector for high-voltage system - TW - .*
- *Visually inspect all potential equalisation lines.*

Check the following when making the visual inspection:

- *There must be no external damage on any component.*
- *The insulation of the high-voltage wiring and potential equalisation lines must not be damaged.*
- *There must be no unusual deformation of the high-voltage wiring.*
- *All high-voltage components must be identified by a red warning sticker.*

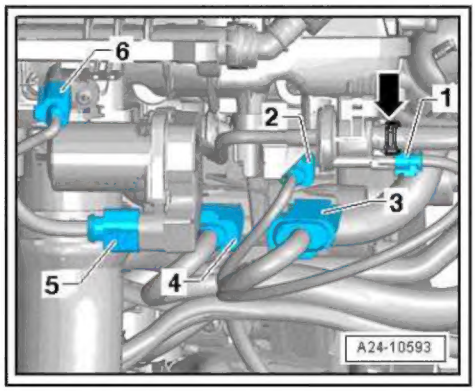
WARNING

Working on vehicles with high-voltage wiring:

- *Do not support yourself or tools on high-voltage wiring or associated components --> this can damage the insulation.*
- *High-voltage wiring must not be excessively bent or kinked --> this can damage the insulation.*
- *The round high-voltage connectors are colour-coded with an external coloured ring and are provided with mechanical coding or guide lugs. It is important to observe this coding when joining up the round high-voltage connectors, otherwise the connectors can be damaged.*

Removing

– Unplug electrical connector -2- at knock sensor 1 -G61- .
– Remove coolant pump with thermostat ⇒ Engine, mechanics; Rep. gr. 19 .



Note

Knock sensor 1 -G61- is located below the intake manifold and behind the coolant pump.

– Unscrew knock sensor 1 -G61- .

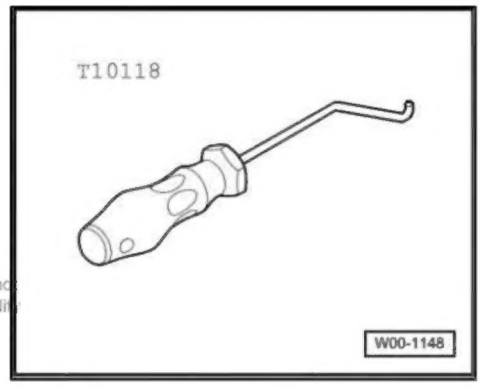
Installing

– Install in reverse order.
- Tightening torque:
⇒ „2.2 Exploded view - ignition system“, page 85

2.5 Removing and installing engine speed sender -G28-

Special tools and workshop equipment required

♦ Assembly tool -T10118-



Safety precautions and repair instructions for vehicles with hybrid drive

DANGER!

Risk of fatal injury if high-voltage components are damaged.

Observe the following when working in the vicinity of high-voltage components or wiring:

- *It is not permitted to use cutting or forming tools, other sharp-edged tools or heat sources such as welding, brazing, soldering, hot air or thermal bonding equipment.*
- *Before starting work, visually inspect the high-voltage components in the areas involved.*
- *Before working in the engine compartment, visually inspect the power and control electronics for electric drive - JX1- , electric drive motor -V141- , air conditioner compressor -V470- and high-voltage wiring.*
- *Before working on the vehicle underbody, visually inspect the high-voltage wiring and covers.*
- *Before working on the rear section of the vehicle, visually inspect the high-voltage wiring and the electro-box with the maintenance connector for high-voltage system - TW - .*
- *Visually inspect all potential equalisation lines.*

Check the following when making the visual inspection:

- *There must be no external damage on any component.*
- *The insulation of the high-voltage wiring and potential equalisation lines must not be damaged.*
- *There must be no unusual deformation of the high-voltage wiring.*
- *All high-voltage components must be identified by a red warning sticker.*

WARNING

Working on vehicles with high-voltage wiring:

- *Do not support yourself or tools on high-voltage wiring or associated components --> this can damage the insulation.*
- *High-voltage wiring must not be excessively bent or kinked --> this can damage the insulation.*
- *The round high-voltage connectors are colour-coded with an external coloured ring and are provided with mechanical coding or guide lugs. It is important to observe this coding when joining up the round high-voltage connectors, otherwise the connectors can be damaged.*

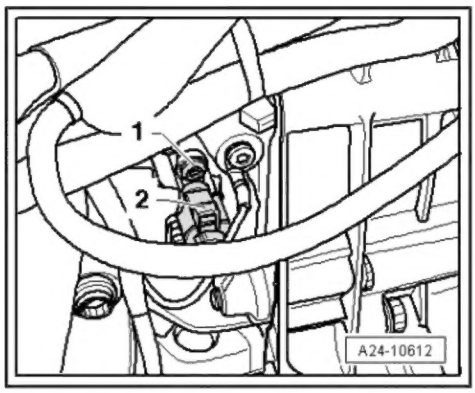
Removing

– Unplug electrical connector at engine speed sender -G28- -2- using assembly tool -T10118- .

Note

To release electrical connector without assembly tool -T10118- , press connector on engine speed sender in with a screwdriver and at the same time lift release tab with a thin wire hook.

– Remove securing bolt -1-.



Installing

Installation is carried out in the reverse order; note the following:

- Tightening torque: refer to overview of fitting locations ⇒ page 13 .